

Current Science



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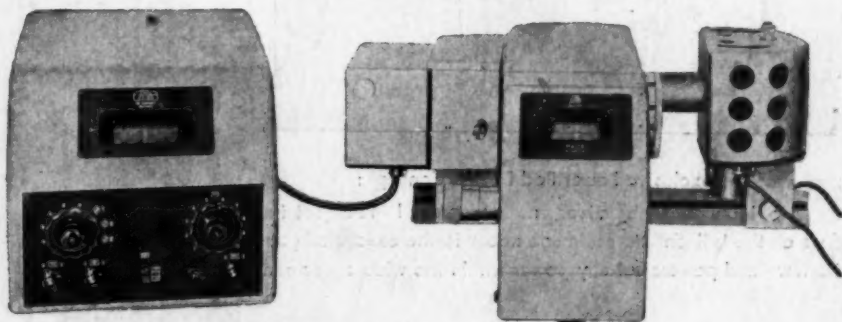
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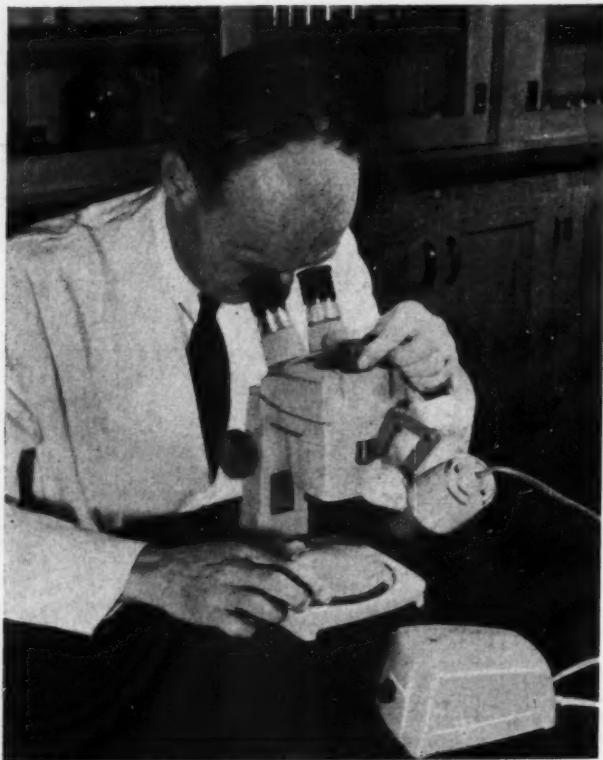
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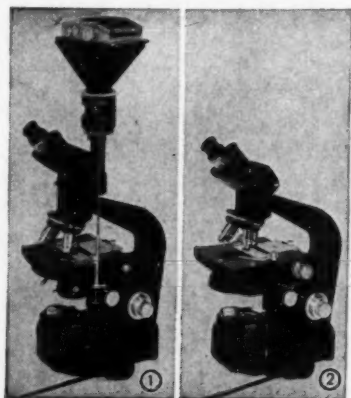


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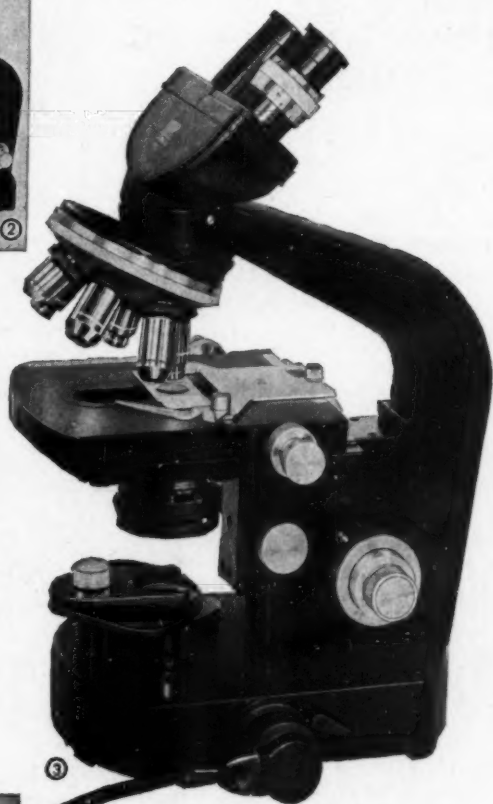
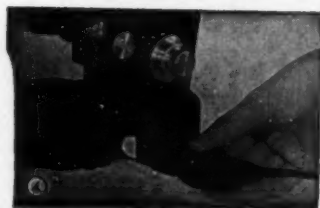


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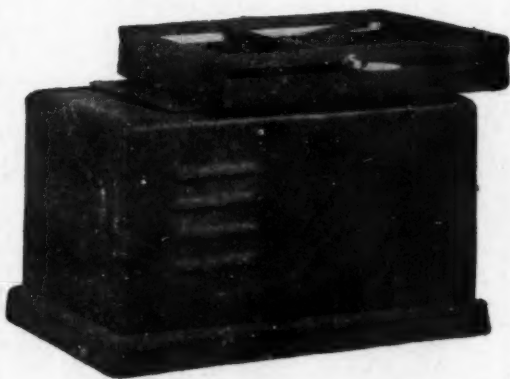
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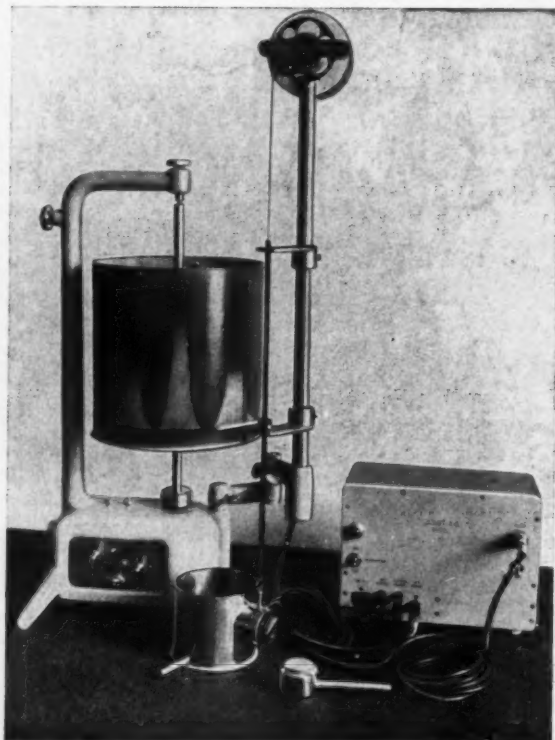
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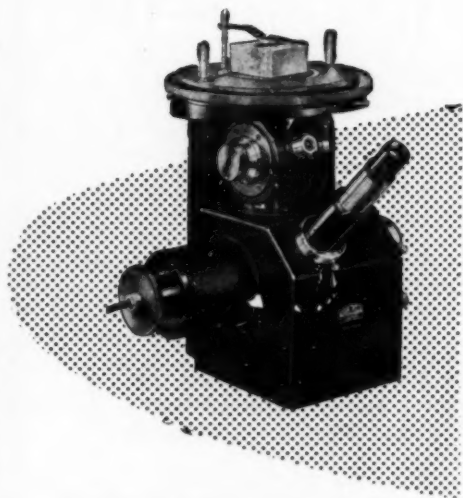
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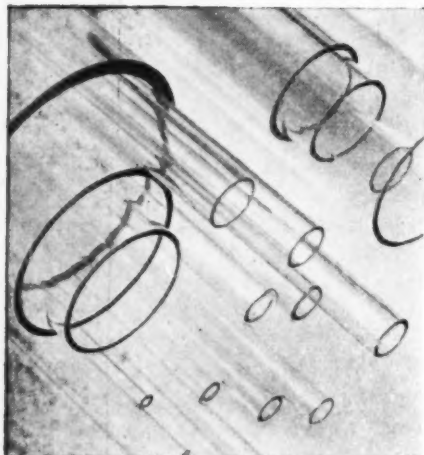
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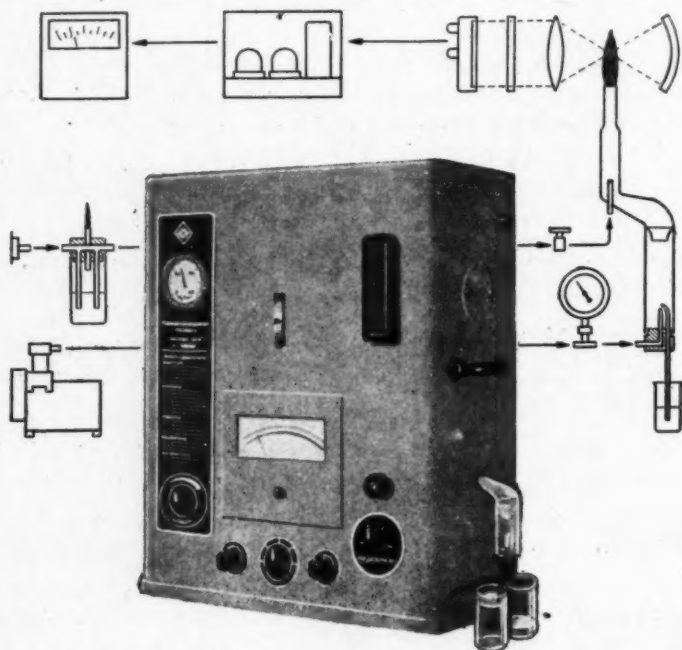
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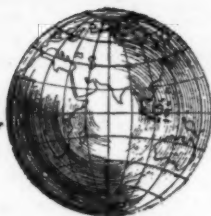
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THE experimental determination of a crystal structure consists of two distinct steps: (i) the determination of the symmetry of the crystal, i.e., the type of its lattice and its space group and (ii) the determination of the atomic arrangement which is consistent with this symmetry and which will satisfactorily account for the intensities diffracted by the different "atomic planes" inside the crystal. The determination of the space group is not altogether a straightforward procedure. Some of the symmetry elements which incorporate the operation of a translation like the screw axis or the glide plane can be recognized by systematic absences in the X-ray reflections. Even here an ambiguity may be introduced because it may happen that extinction in a more general class of spectra may automatically imply extinctions in a less general class. Apart from this there is an inherent difficulty in the determination of space group because X-ray diffraction being of the Fraunhofer type cannot normally detect the presence or absence of a centre of symmetry. However, the expectation expressed by M. J. Buerger that the intensities themselves should provide the information necessary to unambiguously specify the space group has proved essentially correct. Wilson has shown that the presence or the absence of the centre of symmetry can be detected from the study of the distribution of intensities or by computing the average intensities in any particular zone. This statistical method works out most satisfactorily when there are a large number of light but equal atoms in the unit cell. A number of studies on the effect of heavy atoms on the intensity distribution curves have been made. It is now established that the method of local intensity averages can be used to detect such symmetry elements like two-fold axes, mirror planes, etc., which cannot be unambiguously determined from the direct inspection of X-ray diffraction photographs.

The other approach to the problem of the determination of the symmetry elements is through the information obtained from the concentration of peaks in certain planes in the three dimensional Patterson synthesis or in Harker sections. The possibilities of this procedure have been worked out. It is claimed that using these techniques it is now possible to identify 215 out of 219 non-enantiomorphous space groups. The enantiomorphous space groups can theoretically at least be distinguished from crystal morphology or by the use of anomalous scattering techniques. It must be remarked, however,

that while small ambiguities in the space group "have not proved to be a serious obstacle in the determination of crystal structures there is no doubt that the unequivocal determination of the space group at the outset may lead to more rapid and certain progress" (Lipson and Cochran).

Knowing the space group the crystal structure determination cannot, in general, be direct because the information regarding the relative phases of the reflection is lost during the recording of the diffraction spots. However, many complicated structures have been solved by the method of trial and error. Perhaps the most direct method of solving crystal structures would be the isomorphous substitution method. The solving of the structures of the phthalocyanines by J. M. Robertson is perhaps one of the most outstanding successes of this method. The extension of this method to non-centrosymmetric cases by Bijvoet and the development of the double isomorphous substitution method by D. Harker and others are expected to prove extremely fruitful in the determination of complex structures. Another direct method which has been so successfully developed and exploited by Buerger, Robertson and others is the vector set method. This method uses the Patterson synthesis or the method of auto correlation where every available observed datum is incorporated, there being no necessity for the inclusion of such doubtful quantities like the relative phases of the reflections. The principle of the method depends on the fact that when the vector set of points (the Patterson) of a fundamental set (the structure) is known, it is possible by "image seeking" methods, to recover from the vector set the original fundamental set. However, various techniques have been suggested to overcome the difficulties which arise on account of the physical fact that atoms having a spatial extension are unlike the fictitious mathematical points of a fundamental set.

A very important step in the analytical method of direct phase determination was made when Harker and Kaspar discovered that inequalities long known to mathematics (like that of Schwartz) could be applied to the problem of phase determination in at least centro-symmetric structures. Such an application is possible because the density of the scatterer at all points in any crystal (for X-ray diffraction) is always positive, a condition similar to that on which most of these mathematical inequalities are

based. This has been followed by a series of investigations but perhaps the most significant amongst these is the squared atom method of Sayre. This is based on the fact that in a structure of equal, well resolved atoms, if one considers an electron density function which is the square of the normal function, the resultant function would not be very different from the original one, except for a difference in the shape of the peaks. This concept leads immediately to product relationships such that if the structure amplitudes F_{pq} and $F_{h-p, k-q}$ are both large then F_{hk} is almost definitely the sign of their product. The most effective methods of utilising these relationships for the correct assignment of phases have been explored.

As yet no routine method seems to have been found for the solution of the phase problem. But such a claim has been made for the statistical method of Hauptman and Karle. It consists in applying the method of statistics—joint probability methods, to the observed amplitudes and intensities. *A priori* if the atoms whose positions are not known are assumed to be randomly distributed the probabilities of the sign of a reflection are equal. But given a certain set of observed intensities or amplitudes, these probabilities become different from one half each and depend not only on the observed intensities but also on certain quantities called mixed moments solely dependent on space groups. The solution of the structure of dimethoxybenzophenone recently may be said to be one of the outstanding successes of this method.

There is, however, an approach to crystallography which is completely different from the procedures given above. This is based on the pioneering work of Federov and Barlow who speculated about the structures of crystals based on simple packing considerations. The work of Federov on the filling of space with identical polyhedra having the same orientation is well known. He found that this was possible with five types of polyhedra. Later workers have considered the problem of filling space with regular and semi-regular solids either alone or in combination but without the Federov restriction on orientation. Further developments in this method have been associated in recent years with Goldschmidt, Pauling and Wells. These attempts at explaining crystal structure on the basis of packing, rather than the conventional methods of lattice and symmetry, are based on the following considerations, *viz.*, that it is possible to calculate quite generally the field of force around each atom

or other structural unit; it would then be possible to know its bonding requirements and hence one could proceed to compute the spatial arrangement of the lowest potential energy. This would normally be a compromise between the requirements of different kinds of atoms, if more than one kind are involved. If, for example, the field of force is spherical, one could expect the structural unit to form a closed packed structure. But one cannot directly predict which of the closed packed structures—cubic, hexagonal or the more complex varieties—will have the least energy.

A serious attempt to understand the principles underlying the structure of crystals on this basis has been made by Dr. A. F. Wells* and he has presented the experimentally determined crystal structures from the point of view of topology rather than the conventional approach of lattices and symmetry. The procedures adopted by him are somewhat on the following lines. When considering the structure of a substance having a particular formula instead of following the conventional practice of discussing all the known structures of substances of similar formula-type, an attempt is made to derive all the simple structures possible for this formula consistent with the requirements of the atoms involved (like co-ordination number, number of bonds per atom, etc.) and then to discuss the observed structure against this background of crystal geometry. To do this a very careful survey has been made by him of the basic geometry underlying the structure of crystals, the nature of periodic network of connected points, etc. It has even been necessary also to develop the theory of three dimensional networks. Wells not only considers the cases of space filling polyhedra but also those of open packings of polyhedra, close and open packing of equal and unequal spheres. It would be very difficult to give a brief summary of Wells' work but it is indeed most impressive to note how many of the so-called complicated structures make use of extremely simple structural themes. There can be no doubt that this approach to crystallography would prove so fruitful that it should form the subject of intensive study by every serious crystallographer.

S. RAMASESHAN.

* *Solid State Physics*, Vol. 7. Edited by F. Seitz & D. Turnbull. (Academic Press, New York, India: Asia publishing House, Bombay-1), 1958. Pp. xiv + 525. Price \$ 14.00.

BIOGENESIS OF BENZOQUINONES AND RELATED SUBSTANCES

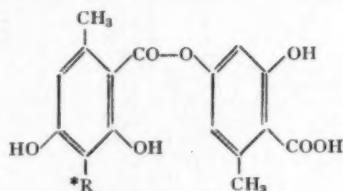
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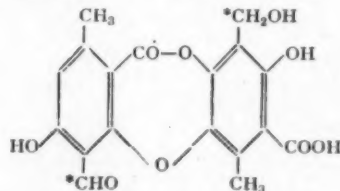
AMONG natural products, benzoquinone derivatives form an important group. They occur widely and a large number of them have been isolated as metabolic products of moulds, fungi, higher plants and insects. Their antibiotic properties are of current interest though the simpler members like fumigatin are known to be toxic. Some of the bigger compounds like embelin are components of drugs and others may have nutritional function (e.g., ubiquinones). They form components of oxidation-reduction systems and can undergo easy reduction to the quinol derivatives which sometimes occur along with the quinones as natural products (e.g., fumigatin and its corresponding quinol). From their large occurrence there is indication of appreciable stability; however they are highly reactive compounds capable of undergoing substitution and also polymerization.

The biogenesis of a large number of benzoquinones seems to have the C_8 -unit as the origin. The C_8 -unit scheme was first formulated¹ for the large number of depsides (I) and depsidones (II) occurring in lichens. In these compounds the presence of C_8 -units is quite as obvious as the C_6 -units in starch and cellulose. The simplest orsellinic unit (III) is found to undergo a number of modifications involving ordinary oxidation and reduction (e.g., IV & V) and also nuclear oxidation (VI) and nuclear methylation (II). Another characteristic feature is the lengthening of one of the side chains (6-position; see VII) of the original C_8 -unit. The newly entering alkyl group also can have large dimensions, a feature noticed more commonly in mould products.

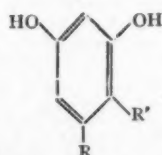
The recent work^{2,3} on the mechanism of the biogenesis of citrinin (VIII) using tracer



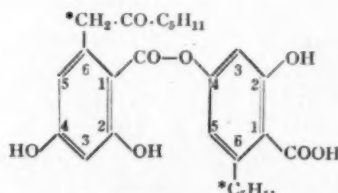
I R = H : Lecanoric acid
VI R = OH : Diploschistic acid



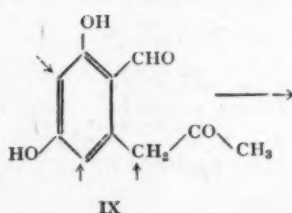
II Protocetraric acid



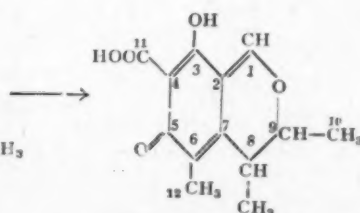
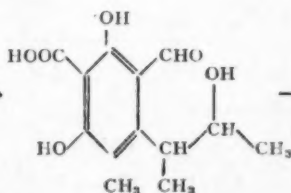
III R = CH₃; R' = COOH
IV R = CH₂OH; R' = CHO
V R = R' = COOH



VII Physodic acid



IX



VIII

technique fully supports the earlier suggestion⁴ based on the C_8 -unit according to which the carbon atoms numbered 11, 12 and 13 are the result of entry of single carbon units. The precursor could be visualized as a keto compound (IX) which can undergo C-methylation not only in the benzene nucleus but also in the particular active centre of the side chain.

The quinones can be considered under a number of heads based on the complexity of the compounds.

1. TOLUQUINONE DERIVATIVES

In the earlier paper by Aghoramurthy and Seshadri,⁴ the similarity between the metabolic products of lichens and moulds was pointed out and the C_8 -unit scheme was shown to be applicable to the toluquinones of fungal origin.

As typical examples, the biogenesis of methoxy-toluquinone, fumigatin, spinulosin and aurantiogliocladiol was explained and this was supported by the laboratory synthesis⁵ of these compounds starting from C_8 -unit systems.

Simple toluquinone and its ω -hydroxy derivative, gentisylquinone, lack the presence of nuclear hydroxyl groups. They could have the same origin as fumigatin except for the incidence of stages of nuclear reduction. The common occurrence of $-CH_2OH$ group as in gentisylquinone has already been pointed out. Two possibilities exist: (i) hydroxylation of the active methyl group or (ii) hydroxymethyl being the earlier stage undergoing reduction to a methyl group. The co-occurrence of o - and p -xyloquinones and trimethylbenzoquinone

TABLE I



Compound	Position of substituents	Source
1 Toluquinone	.. 2-Methyl	Flour beetles
2 Gentisylquinone	.. 2-Hydroxymethyl	<i>Penicillium patulum</i> , <i>P. divergens</i>
3 <i>o</i> -Xyloquinone	.. 2:3-Dimethyl	Arachnids
4 <i>p</i> -Xyloquinone	.. 2:5-Dimethyl	do.
5 Trimethylbenzoquinone	.. 2:3:5-Trimethyl	do.*
6 Methoxytoluquinone	.. 5-Methoxy-2-methyl	<i>Coprinus similis</i> , <i>Lentinus degener</i>
7 Fumigatin	.. 6-Hydroxy-5-methoxy-2-methyl	<i>Aspergillus fumigatus</i>
8 Spinulosin	.. 3:6-Dihydroxy-5-methoxy-2-methyl	<i>A. fumigatus</i> , <i>Penicillium spinulosum</i>
9 Aurantiogliocladiol	.. 5:6-Dimethoxy-2:3-dimethyl	<i>P. cinerascens</i> <i>Gliocladium</i> spp.

TABLE II



Compound	Position of substituents	Source
1 Embelin	.. 3:6-Dihydroxy-2-undecyl	<i>Embelia</i> spp., <i>Myrsine</i> spp., <i>Rapanea neurophylla</i>
2 Rapanone	.. 3:6-Dihydroxy 2-tridecyl	<i>Rapanea maximowiczii</i> , <i>Oxalis purpurata</i> var. <i>jacquinii</i>
3 Mæsaquinone	.. 3:6-Dihydroxy-5-methyl-2-nonadecyl	<i>Mæva japonica</i>
4 Ubiquinones	.. 5:6-Dimethoxy-2-methyl- 3 $[CH_2-CH=C-CH_2]_{6-10}.H$ CH ₃	Pig's heart, baker's yeast
5 Ethylbenzoquinone	.. 2-Ethyl	Flour beetles

would suggest that they have resulted by the further nuclear methylation of toluquinone (by free radical process) or of the corresponding quinol (by ionic reactions or formaldehyde condensation). The importance of these methylbenzoquinones in relation to vitamin E has been discussed by Rao and Seshadri⁶ and this will be mentioned again later on.

2. TOLUQUINONES WITH LENGTHENED SIDE CHAIN

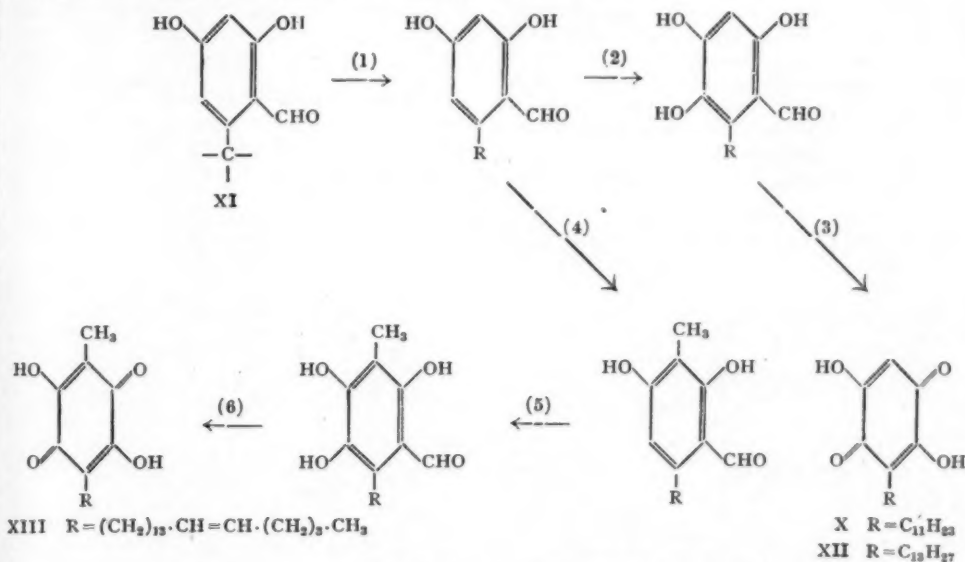
Embelin (X) is a derivative of 3:6-dihydroxy-2-methylbenzoquinone and its biogenesis from the appropriate C_8 -unit (XI) can be represented as given below. Rapanone (XII) differs only in having a longer side chain and mæsaquinone (XIII) contains an extra methyl group and the position occupied by this is the normal γ -position of the orsellinic (C_8 -) unit. Ubiquinones (XIV) can be more directly

derived from 5:6-dimethoxy-2-methylbenzoquinone (fumigation methyl ether) (XV) involving substitution in the 3-position by isoprene system. This is analogous to what is found in the case of vitamin K₂.

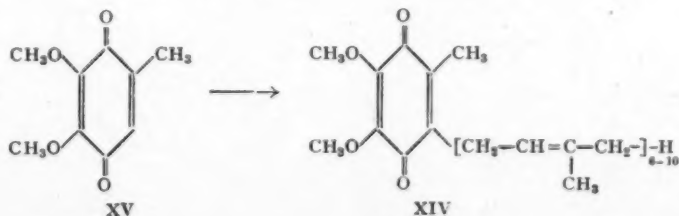
Ethylbenzoquinone, though a simple molecule, is somewhat exceptional in having an even (two carbon) side chain but it could be included in the toluquinone group if a propionic acid side chain (C_3) could be considered to undergo decarboxylation. This feature is commonly found in the porphyrin series where the propionic acid and ethyl side chains are found.

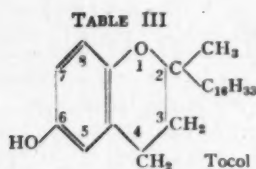
3. TOCOPHEROLS

A number of tocopherols have been isolated from vegetable oils like wheat germ oil and cotton-seed oil and also from leafy vegetables (Table III).



Reactions: (1) Chain lengthening; (2) Para nuclear oxidation; (3) Ortho nuclear oxidation; (4) Nuclear methylation; (5) Para N.O.; (6) Ortho N.O.





Compound		Position of substituents
1 α -Tocopherol	..	5 : 7 : 8-Trimethyl
2 β -Tocopherol	..	5 : 8-Dimethyl
3 γ -Tocopherol	..	7 : 8-Dimethyl
4 δ -Tocopherol	..	8-Methyl
5 ϵ -Tocopherol	..	5-Methyl
6 η -Tocopherol	..	7-Methyl
7 ζ -Tocopherol	..	5 : 7-Dimethyl

The relationship between the simple methyl substituted benzoquinones (Table I) and the tocopherols (Table III) is quite suggestive. It would appear that the corresponding quinols are the important intermediates. In plants, they undergo condensation with phytol to yield the tocopherols whereas in insects they undergo oxidation giving the corresponding quinones. The occurrence of the related series in the two places is highly significant.

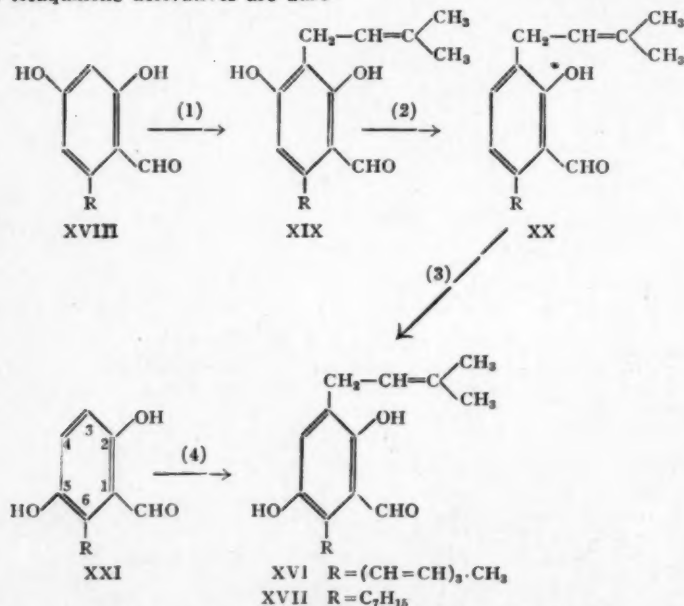
4. QUINOL DERIVATIVES

Two mould products which are closely related to the toluquinone derivatives are auro-

glauin and flavoglauin. Their constitutions have recently been revised⁷ as (XVI) and (XVII) respectively and the new structures fall into the C_8 -unit scheme better. The main steps are chain lengthening (XVIII), nuclear prenylation (XIX) in the 3-position followed by nuclear reduction (XX) and *para* nuclear oxidation (XVI & XVII). In the orsellinic unit, entry of alkyl and other electrophilic groups is facile in the 3-position located between the two hydroxyl groups and hence the above suggestion (reaction 1). However, since reactive groups like the prenyl attack the quinol systems⁸ also easily, the alternative prenylation of the alkyl substituted gentisic aldehyde (XXI) cannot be excluded. In this case, the 3-position will get preferentially activated by the *para* alkyl whereas the 4-position will be deactivated by the *para* aldehyde and hence the formation of the compounds (XVI & XVII) can be explained.

Benzoquinones of other origins

Though C_8 -units occur widely and there is great validity for the C_8 -unit origin of a large number of quinones and their derivatives, the scheme should not be pressed into service everywhere indiscriminately. There seem to be simpler and more natural alternative routes in



Reactions: (1) Nuclear prenylation; (2) Nuclear reduction; (3) *Para* nuclear oxidation; (4) Nuclear prenylation.

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Biogenesis of Benzoquinones and Related Substances

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many other cases. Some typical examples are given below.

1. Simple benzoquinone derivatives

TABLE IV

Compound	Source
1 Benzoquinone	Insects
2 Methoxybenzoquinone	Wheat germ
3 2:5-Dimethoxybenzoquinone	<i>Polyporus fumosus</i>
4 2:6-Dimethoxybenzoquinone	Wheat germ, <i>Adonis vernalis</i>

These are lacking in C-methyl groups and have methoxyl groups instead. A natural derivation would be from inositol (XXII) which is widely occurring in Nature and which can undergo ready oxidation to inosose and tetrahydroxy-p-benzoquinone (XXIII). These oxidations can be carried out fairly readily by means of nitric acid; further they are known to be effected by micro-organisms also.⁹ From the tetrahydroxyquinone (XXIII), graded loss of hydroxyl groups followed by methylation would account for the abovementioned compounds.

group are thelephoric acid (XXIV) and volucrisporin (XXV).

The biogenesis of this group of quinones has been suggested by Seshadri¹² as involving the linking of two C₆-forked units. Thelephoric acid (XXIV) and volucrisporin (XXV) are of special interest. Thelephoric acid was formerly considered to be a phenanthrene-quinone pigment, but recent work has shown that this structure needs change. It probably contains two methylenedioxy groups and belongs to the terphenyl series. Volucrisporin (XXV) has no para-

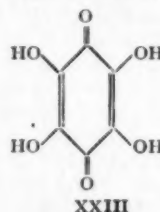
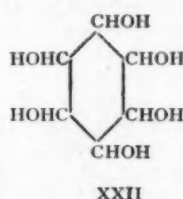
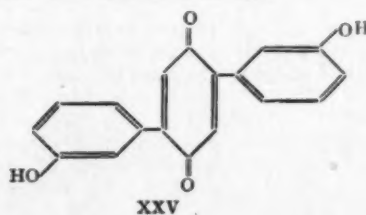
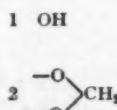
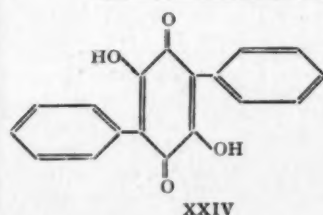


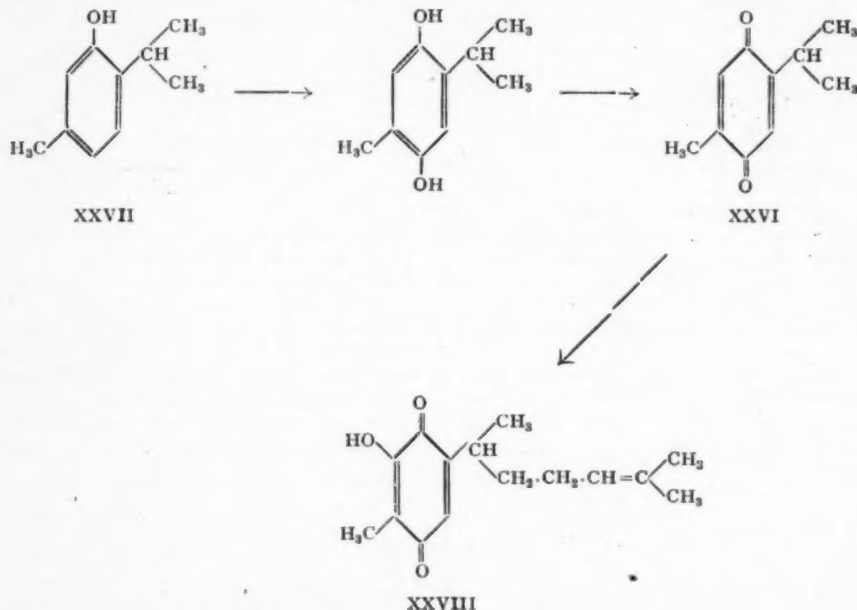
TABLE V

Compound	Source
1 Polyporic acid	<i>Polyporus nidulans</i> , <i>P. rutilans</i> , <i>Penisphora filamentosa</i> , <i>Sticta coronata</i> , <i>S. colensoi</i>
2 Atromentin	<i>Paxillus atrotomentosus</i>
3 Leucomelone	<i>Polyporus leucomelas</i>
4 Muscarufin	<i>Amanita muscaria</i>
5 Thelephoric acid ¹⁰	<i>Thelephora palmata</i> , <i>Lobaria isidioides</i>
6 Volucrisporin ¹¹	<i>Volucrispora aurantiaca</i>



dihydroxy group and possesses a *meta*-hydroxy-phenyl system. It seems to be possible that a catechol system is the real precursor and both the *para* and *meta* hydroxy compounds arise by selective reduction at some stage.

and (iv) quinol derivatives. However, simple benzoquinone derivatives, terphenylquinones and thymoquinone derivatives have other origins, e.g., inositol, C₉-units and terpenoid systems.



3. *Thymoquinone derivatives*.—Compounds belonging to this group seem to be rather exceptional. Thymoquinone (XXVI) itself occurs in the seeds of *Carum roxburghianum*, heartwood of *Tetractelis articulata* and in the incense cedar. Hence it is natural to expect that it is derived from thymol (XXVII) by oxidation. Therefore it has a terpene origin. A compound which seems to be closely related to thymoquinone would be perizone (XXVIII). The additional stages involved are chain lengthening of the C₈-system by means of an isoprene unit and introduction of a hydroxyl group.

SUMMARY

The C₈-unit scheme satisfactorily accounts for the biogenesis of (i) toluquinone derivatives, (ii) extended toluquinones, (iii) tocopherols

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ON THE USE OF THE TERM "CHARNOCKITE DYKE"

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THE term 'charnockite dyke' has often been used somewhat loosely to designate basic dykes which contain hypersthene irrespective of their field relations or the metamorphic grade attained by such rocks. There are basic dykes of different ages and of many petrographic types in the charnockite province of India—varying from epidiorites to granulites. Some of the dolerite dykes are hypersthene-bearing, and some contain olivine. It is necessary, therefore, to be clear about the differences which exist among basic dykes which contain minerals normally found in charnockites, but which have had different modes of origin.

When Holland published his classic memoir in 1900 on the Charnockite Series of South India, he not only described massive outcrops, but also referred to the occurrence of these rocks as dykes. He observed that they are often found as 'bands' with sharp boundaries, and running parallel to the foliation of the biotite gneiss in which they lie. They do not exhibit glassy or felsitic selvages, though the borders are sometimes more compact than the interior. The texture is granulitic, but the rocks are finer in grain than the average massive form of the charnockite series. Holland considered that this difference in grain was just the same in degree and kind as would be seen between a large stock of gabbro and its corresponding dolerite dyke phase. He thought that the presence of such dykes corroborated other evidences which, according to him, pointed to the igneous origin and intrusive behaviour of the charnockite series.¹

The exact date of publication of Wetherell's Memoir on 'The Dyke Rocks of Mysore' is not known but it was somewhere in the period between 1902 and 1905. In his four-fold classification of basic dykes, he considered 'Granulites' as the dyke equivalents of the basic charnockite series.²

'Dyke-like' inclusions of hypersthene granulites were noticed by Slater in the gneisses of Mysore State.³ Jayaram⁴ considered the dark finer-grained hypersthene-augite granulitic dykes as 'genetically related to the charnockite magma of a later period of consolidation'.

When geologically surveying the southern portion of Hassan District in Mysore State, Sampat Iyengar came across 'basic charnockites' occurring as 'thin parallel dykes' in the

gneiss. They generally exhibited a granulitic texture, but when coarse-grained they had a peculiar greasy appearance. He believed that these dykes in the south-west corner of Hassan District were connected with the massive bodies of basic charnockites that occur in Coorg and its neighbourhood.⁵ He noticed that these dykes are sometimes cut across by pink granite veins, and that in a few places they occur for some distance as irregular disconnected patches in the granite.

Later, Jayaram, in his report on the Closepet granites and associated rocks, considered that the end phase of the charnockite magma was represented by a number of hypersthene-bearing granulite dykes which were intruded into parallel fissures.⁶ He also recorded that the hypersthene-bearing dykes, like the hornblende granulites, did not show any marked chilled edges, though sometimes finer, crushed and more hornblende portions characterized the edges of these dykes.⁷

Smeeth⁸ also considered that the charnockites which form the great mass of the Nilgiris 'come into Mysore on its eastern, southern and western borders where they are found distinctly penetrating the Peninsular gneiss both as tongues and as basic dykes'.

Rama Rao,⁹ on the contrary, found that 'the region which has been mapped as showing tongues of the charnockites forking into their adjacent Peninsular gneiss resolves into an inter-banded series of charnockites and biotitic gneisses; and the former does not transgress anywhere the strike of foliation of the gneissic granites'.

Rama Rao later stated that the types which have been mapped in Mysore State as the dyke phases of the charnockite series, though megascopically similar, disclosed much variation in their textural details. He grouped them broadly into olivine norites and granulitic hornblende norites, but observed that while they showed a striking general resemblance to the basic charnockites, especially in their mineral composition, they differed in several minor details not only from the latter but even among themselves.¹⁰

It was Rama Rao, however, who for the first time visualized the possibility of some of the basic intrusives developing a granulitic texture and passing on 'by progressive stages to a

hornblende hypersthene biotite granulite, hardly distinguishable from a typical basic charnockite'.¹¹

On going through the literature, it appears that the earliest occasion in Mysore when the post-Archæan basic dykes were confused with the earlier ones was in 1911 when Sampat Iyengar, after describing typically granulitic dykes, goes on to say that the fine-grained dykes

The writer would like to propose the discontinuance of the term 'charnockite dyke' as it suggests a magmatic origin. If it is to be used at all, it should be confined to describe rocks of charnockitic regions which have the following characters:—

1. *Mode of occurrence.*—Parallel bands or dyke-like masses, generally not showing cross-cutting relations with gneissic rocks.^{1,9} Where

Photomicrographs of granulitic dykes

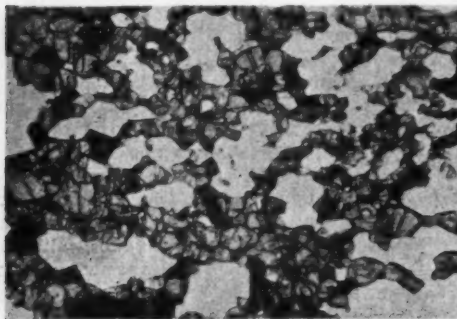


FIG. 1. The classic Fraserpet dyke described by Holland, which outcrops on the bed of the river Cauvery on the Coorg-Mysore border. Note the granulitic texture, rough banding, and water-clear nature of the feldspars. $\times 9$.

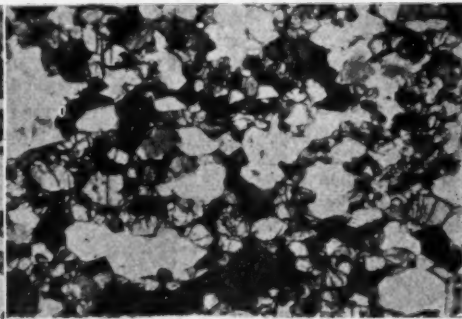


FIG. 2. The same section as in Fig. 1, between crossed nicols. The plagioclases are seen to be generally untwined. $\times 9$.

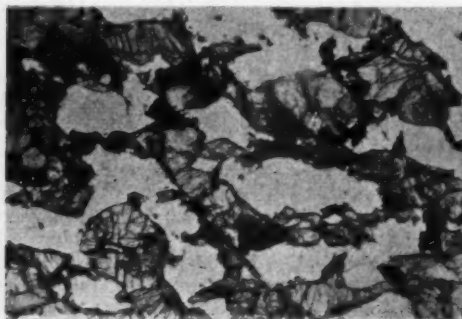


FIG. 3. Dyke, near Talkad, Mysore State. The pyroxenes and brown hornblendes are drawn out into somewhat parallel bands. The feldspars are clear and unclouded. $\times 9$.

are often highly hornblendic, and that in many sections hypersthene granules are unrecognizable when, according to him, it becomes a matter of considerable difficulty to distinguish such rocks from the fine-grained hornblende schists.¹² Since then, it is apparent in the writings of many others that some of the later dykes have often been considered to have been related to the charnockites.

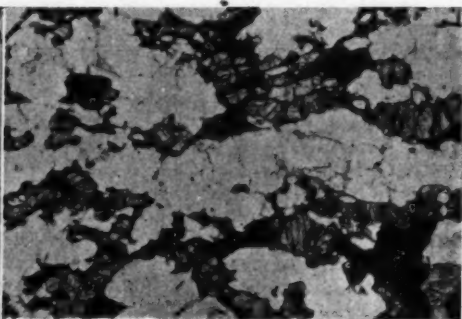


FIG. 4. Dyke from the Shevaroy Hills, Salem District, Madras State. The minerals are disposed in roughly parallel streaks. There is no clouding of the feldspars. $\times 9$.

such rocks transect the prevailing foliation, the dyke-like runs are cut up, and enclosed by granites and gneisses.^{5,13}

2. *Structure.*—Sharp contact with country rock but with no glassy or felsitic selvage.^{1,7}

3. *Texture.*—Though granulitic, there is generally a rough banding (Figs. 1, 3, 4). This feature was noticed quite early by Wetherell.¹⁴

4. *Feldspar*.—The plagioclases are free from clouding, and generally water-clear. There is no great tendency for twinning^{1,15} (Fig. 2).

The writer has recently put forward the suggestion that there are charnockites of two different ages, an earlier type formed by the regional metamorphism of pre-existing rocks, and a later type derived from metasomatism and rheomorphism.^{16,17} The former is gneissic or granulitic, and the latter granitic and coarse-grained.

In the light of the above explanation, it follows that these so-called charnockite dykes belong to the earlier phase when basic dykes of Dharwar age were regionally metamorphosed and reconstituted into granulitic or gneissic charnockites containing hypersthene and clear plagioclase.

The post-Archæan dykes of various petrographic types, some of which are hypersthene-bearing, have chilled against the charnockites of the earlier period, generally retained their igneous textures such as ophitic, and have had

clouding induced in plagioclase, pyroxene, and olivine, due to the regional thermal metamorphism caused by the later formed metasomatic charnockites.

The two groups of dykes can, therefore, be clearly distinguished by their field relations, texture, and clouding of minerals.

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LUNIK II—THE RUSSIAN MOON ROCKET

WHAT will go down as a remarkable achievement in the history of cosmic space rocketry was the successful launching by Russia of the Moon Rocket, Lunik II, which landed on the moon almost to the minute according to schedule, thus accomplishing the first space flight from the earth to another celestial body. The rocket was launched on the afternoon of Saturday, September 12, 1959. The final stage of the rocket hit the moon at 00 hours 2 minutes 24 seconds (Moscow Time) on Monday morning, September 14, 1959.

The rocket moved along a trajectory near to that calculated in advance and the time and place of its hitting the moon had been accurately forecast. The time of impact was to be at 1 minute 1 second past midnight, September 14, and the place of impact was to be in the triangular region of the moon's surface bounded by the Sea of Serenity, the Sea of Vapours and the Sea of Tranquility.

The last stage was a guided rocket weighing 1,511 kg. (3,324 lb.), without fuel, and included scientific and measuring equipment, energy sources and container, of total weight 390 kg. (860 lb.). It contained a remote control device which would correct its "very small" deviation from the planned trajectory as it sped towards the moon. The accuracy of 1 minute 23 seconds on a journey of a quarter of a million miles proves a "tremendous achievement of radio navigation".

The rocket took approximately 34 hours to travel from the earth to the moon which was 374,000 km. (233,600 miles) away at the time of impact.

A sodium cloud emitted by the rocket on the first night of its flight was observed and photographed.

The rocket was sending back continuous radio signals and these were heard clearly but faintly until 20 minutes before it hit the moon. The signals began to fade badly and shortly afterwards were inaudible altogether, which was the indication that the rocket had landed on the moon. The giant radio telescope at Jodrell Bank kept track of the rocket till its impact "less than 90 seconds behind schedule".

The impact would not have been visible even through the world's most powerful telescope. A space ship hitting the moon would have to be at least 200 yards in diameter for the landing to be visible from the earth.

The Budapest Observatory, however, reported that at the time of the rocket's landing on the moon a black circle was noticed through the observatory's 7-inch refractor, on the surface of the moon in the region of the expected impact. The black ring remained visible for 58 minutes and is believed to be the moon's surface dust raised by the impact.

Special steps were taken to ensure that no earthly micro-organisms were carried to the moon by the rocket.

INDIAN INSTITUTE OF SCIENCE, BANGALORE—GOLDEN JUBILEE SYMPOSIA

AS part of the Golden Jubilee programme the different Departments of the Institute are holding a series of symposia during the year. Four symposia were held in August. They were on "Polarography" arranged by the Department of General Chemistry; "Biology and Biochemistry of Micro-organisms", "Enzymes" and "Vitamins" arranged jointly by the Departments of Biochemistry, Pharmacology and Fermentation Technology Laboratories. The symposia were inaugurated by Dr. S. Bhagavantam, Director of the Institute, and attended by delegates from centres of research in the respective fields of study all over the country.

SYMPOSIUM ON "POLAROGRAPHY"

The first day's proceedings were presided over by Dr. K. S. G. Doss, who delivered an address on the "Effect of surface-active substances on the dropping mercury electrode capacity". On the second day Dr. M. R. A. Rao gave a lecture on the "Importance of Diffusion Coefficient in Polarography" in which he emphasized on the need for measuring the diffusion coefficients under polarographic conditions for elucidating the correct reaction mechanism, particularly in complex reduction processes as occur in nitrophenols. Dr. R. S. Subrahmanya reviewed the polarographic work done at the Institute with respect to inorganic and organic polarography. He dealt particularly with the interpretation of irreversible polarographic waves. On the final day Dr. N. A. Ramiah spoke on "Polarographic Method of Determination of Stability Constants of Metal-chelate Complexes".

Sixteen papers were presented for discussion. Among contributions received from polarographers outside India were those by Prof. Kolthoff, by Prof. von Stackelberg, by Prof. Wawzonek and by Dr. Furness and their collaborators. These were presented by Dr. Subrahmanya for discussion.

Fifteen polarographic workers from different parts of India took part in the symposium. The discussions were mainly on the following aspects: The irreversibility of the polarographic waves, the effect of surface-active substances on polarographic wave-forms, the use of Ilkovic equation, the role of movement in explaining certain obscure phenomenon in polarography, correlation between the decrease in the double layer capacity and the efficiency of vapour phase corrosion inhibitors, precautions to be taken in employing linear diffusion method for diffusion coefficients, the care involved in standardising methods for estimating substances polarographically in presence of interfering

substances and the complications that would occur in organic reductions due to tar formation.

SYMPOSIA ON "MICRO-ORGANISMS", "ENZYMES" AND "VITAMINS"

These symposia were attended by over 200 scientists including 50 delegates from the various centres of biochemical research.

Major-General S. L. Bhatia who presided on the first day of the session, gave an address on the "Progress of Physiology and Biochemistry in India". The President for the second day Dr. P. S. Sarma gave an account of the contributions of the late Prof. K. V. Giri in the field of enzymes. On the third day Dr. V. N. Patwardhan in his presidential address presented a review of the mode of action of vitamin D—a field in which he himself has made significant contributions.

Dr. V. Subrahmanyan gave an account of the work carried out in the Department of Biochemistry during his long association with it. Prof. M. Sreenivasaya described the physico-chemical and ultra-micro methods developed by him for the study of enzyme systems.

There were four evening lectures: (1) "Pentose Phosphate Metabolism" by Dr. D. P. Burma of the Bose Research Institute, Calcutta, (2) "Purification of Enzymes" by Dr. B. K. Bachhavat of the Christian Medical College, Vellore; (3) "Protein Synthesis" by Dr. P. M. Bhargawa of the Regional Research Laboratory, Hyderabad, and (4) "Coenzyme Q" by Dr. T. Ramasarma of the Indian Institute of Science, Bangalore.

Over 60 original papers were presented by the delegates and members of the respective departments. The symposium on "Biology and Biochemistry of Micro-organisms" was divided into three sections—General Microbiology, Industrial and Agricultural Microbiology and Metabolism of micro-organisms. Some of the high-lights of the papers presented in these three sections were: the discovery for the first time the nucleus and vacuole in the living cell of yeast, the production of bacterial diastase and protease for desizing, leather bating and cheese making and the synthesis of proteins and itaconic acid in bacteria. The papers under "Enzymes" included the purification of certain vital enzymes from the brain and from plants and the induction of enzymes in the rice moth larvae which throw light on the fundamental biochemical problems. Under "Vitamins" among other papers, the action of vitamin A in vision, the possible role of certain anti-vitamins in cancer cure in experimental animals, and the evaluation of vitamins in human milk were discussed.

LETTERS TO THE EDITOR

THE NUCLEAR SCATTERING OF 970 Mev. PROTONS BY CARBON

RECENTLY experimental observations on the differential scattering cross-sections and nucleonic polarization for the elastic scattering of 970 Mev. protons by carbon have been obtained by Batty and Goldsack.¹ It is reasonable to assume that the first Born approximation is valid for the nuclear scattering of such high energy protons by light nuclei and the observed polarization. Following Malenka,² the total nuclear potential may be written as

$$U(\vec{r}) = U_0(r) + U_r(r) \frac{1}{2} \vec{\sigma} \cdot (\vec{r} \times \vec{k}) \quad (1)$$

where

$$U_0(r) = -2k\bar{n}\rho(r), \quad U_r(r) = -2k\bar{n}_1\rho_r(r),$$

while $\vec{k} = -i\nabla$ and $\vec{\sigma}$ is the usual Pauli Spin Operator. Assuming the distribution $\rho_r(r) = a\rho(r)$

where a is a constant and $\bar{n} = \bar{n}_1 + i\bar{n}_2$, we have for a characteristic nuclear density distribution

$$U(\vec{r}) = -2k\rho(\vec{r}) \left\{ \bar{n} + \frac{a}{2} \bar{n}_1 \vec{\sigma} \cdot (\vec{r} \times \vec{k}) \right\} \quad (2)$$

where $\vec{k} = \vec{k} \times A^{1/3}$ and $\vec{r} = \vec{r} \times A^{-1/3}$. The expressions for the scattering cross-section $\sigma(\vec{S})$ and the polarization function $P(\vec{S})$ in the above approximation are given by the relations

$$\sigma(\vec{S}) = 4k^2 A^2 \left[|\bar{n}|^2 h^2 + \frac{k^2 (\bar{n}_1 a)^2}{4} h'^2 \right] \quad (3)$$

$$P(\vec{S}) = - \frac{k(\bar{n}_1 a) \bar{n}_2 h h'}{|\bar{n}|^2 h^2 + \frac{k^2 \bar{n}_1^2 a^2}{4} h'^2} \quad (4)$$

where

$$h = \frac{1}{\vec{S}} \int_0^\infty \rho(\vec{r}) \sin(\vec{S} \cdot \vec{r}) \vec{r} d\vec{r}$$

and

$$h' = \frac{d}{d\vec{S}} [h]$$

with

$$\vec{a} = a \times A^{1/3}, \quad \vec{S} = \vec{S} \times A^{1/3} \text{ and } S = 2k \sin(\theta/2).$$

A characteristic nuclear density distribution

$\rho(\vec{r})$ for light elements has been obtained by Gatha, Shah and Patel³ from an analysis of the experimental data on the nuclear scattering of 340 Mev. protons. Subsequently, Gatha and

Shah⁴ have obtained from the same data a revised characteristic nuclear density distribution given by

$$\rho(\vec{r}) = a_1 \exp(-b_1 \vec{r}^2) + a_2 \exp(-b_2 \vec{r}^2) \times (1 - b_3 \vec{r}^2 + b_4 \vec{r}^4) \quad (5)$$

where

$$a_1 = 0.12 \times 10^{39} \text{ cm.}^{-3}, \quad a_2 = 0.25 \times 10^{39} \text{ cm.}^{-3}, \\ b_1 = 8.62 \times 10^{26} \text{ cm.}^{-2}, \quad b_2 = 1.09 \times 10^{26} \text{ cm.}^{-2}, \\ b_3 = 0.44 \times 10^{26} \text{ cm.}^{-2}, \quad b_4 = 0.13 \times 10^{32} \text{ cm.}^{-4}.$$

In the present investigation h and h' have been calculated using equation (5). The value of

\bar{n}_2 has been taken equal to 19.5 mbn. from the experimental observations of the scattering cross-sections for the (n, n) and (n, p) scattering respectively. The value of \bar{n}_1 as given by Jastrow's⁵ model for nucleon-nucleon interaction will be vanishingly small at such a high energy.

Therefore, $\bar{n} \simeq \bar{n}_2 = 19.5 \text{ mbn.}$ We have also

found that $\bar{n}_1 a = 1 \text{ mbn.}$ gives the best agreement between the theoretical and the experimental value of $P(\vec{S})$.

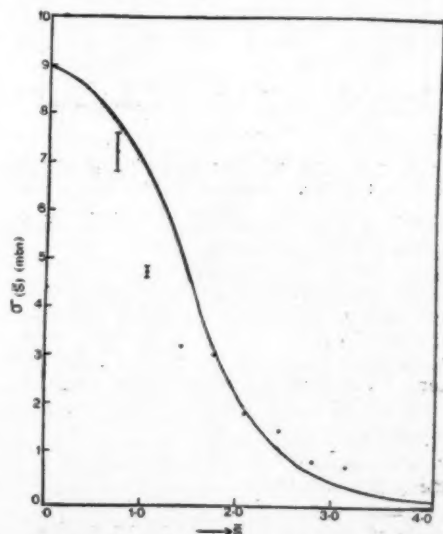


FIG. 1. Diffraction pattern for the nuclear scattering of 970 Mev. protons by carbon.

The theoretical $\sigma(\bar{S})$ and $P(\bar{S})$ have been calculated from equations (3) and (4) and are plotted against (\bar{S}) in Figs. 1 and 2 respectively. The experimental values of $\sigma(\bar{S})$ and $P(\bar{S})$ as obtained by Batty and Goldsack¹ have also been plotted together with their probable errors in Figs. 1 and 2. It is clear that there is an approximate fit between the theoretical and the experimental values of $\sigma(\bar{S})$, while there is a reasonable agreement between the theoretical and the experimental values of $P(\bar{S})$. It may be noted that the errors shown in Fig. 1 are statistical only and the absolute values of the cross-section may be in error by $\pm 50\%$ owing to poor beam monitoring.

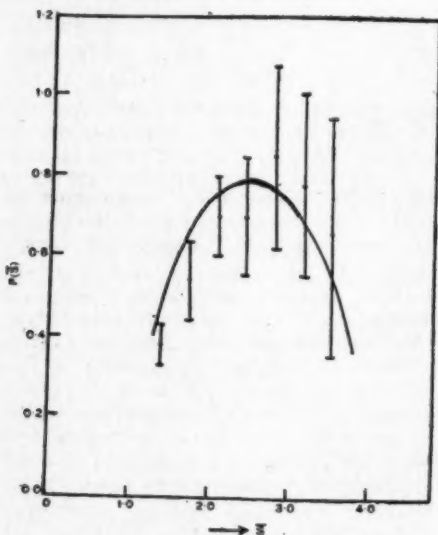


FIG. 2. The nucleonic polarization $P(\bar{S})$ as a function of \bar{S} for 970 Mev. protons scattered by carbon.

Therefore, it can be concluded that the above complex nuclear potential, based upon the above characteristic nuclear density distribution, can approximately correlate the experimental data on the nuclear scattering and polarization of 970 Mev. protons by carbon. However, the deviations from the general trend may perhaps be due to the approximate nature of the concept of a characteristic nuclear density distribution.

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K. M. GATHA.

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PORTABLE THERMISTER THERMOMETER FOR ESTUARINE INVESTIGATION

THE standard methods for the measurement of temperatures in the sea is by the use of Bathy-thermograph or by special reversing thermometers. Both these instruments can be usefully employed in deeper sea and are not suited for measurements in shallow water channels for hydrologic studies. The reversing thermometers are useful only at preset depths and can give spot measurements at only one or two points in shallow channels while the grid of the Bathy-thermograph would not show any readable accuracy for temperature measurements if used for this purpose. It was, therefore, felt necessary to develop a portable thermister thermometer which could be used for continuous measurements of temperatures for hydrologic studies in estuaries 50 to 100 feet deep.

A thermister type F 2311/300 with a negative temperature coefficient was selected as the temperature measuring element. It was mounted inside a perspex tube provided with two water-tight stoppers at one end and the other was open with a number of holes on the sides. The perspex tube was mounted on a suitable frame of sufficient weight to carry the probe down vertically. A two-core water-tight cable connected the thermister and was run along the steel rope which lowered the frame from a winch or a derrick from on board the ship. It could also be lowered from small boats. 100 feet of cable has been provided with the probe for measuring temperatures. The depth is measured by the length of the steel rope paid out from the winch.

The thermister with the cable forms part of a Wheatstone Bridge of the type used by McLean.¹ It is particularly useful for the study of microthermal structure of sea-water as the size and thermal capacity of the thermister bead is very small. The Bridge can be easily balanced with a thermister of good stability² for initial surface temperature of the sea-water when the galvanometer reads null. A small variation of temperature then produces

an out-of-balance current in the bridge which is measured on a micrometer. A sensitivity of $2.2 \mu\text{A}/^\circ\text{C}$. has been obtained in the range 25° to 35°C .

This thermometer has been used to measure temperature variations in the Ernakulam channel up to a depth of 30 ft. (Fig. 1). It can

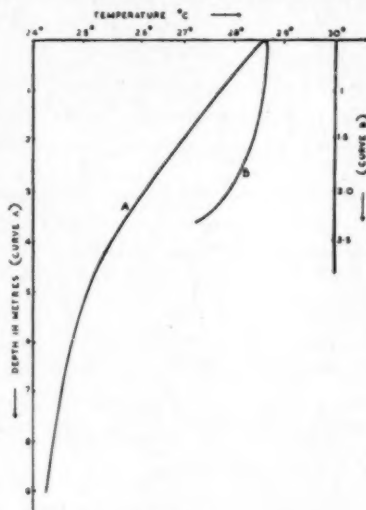


FIG. 1

also be used for measuring air temperature in the first 100 feet above ground for super-refraction work. It can be used with a D.C. amplifier to study microthermal structures of sea layers in open seas, which are responsible for wide fluctuations of sound intensities in Asdic work.

One of the authors (V.S.R.) is thankful to the Ministry of Education and Cultural Affairs, for the grant of a stipend.

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April 10, 1959.

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OXIDATION OF XYLENES IN THE FLUIDISED BED

BHATTACHARYYA AND GULATI¹ have recently reported the results of their interesting and important investigations on the vapour phase oxidation of xylenes in the static bed using large number of catalyst compositions containing vanadium, molybdenum, tungsten, uranium, etc., under various experimental conditions. They found that vanadium containing catalysts

were superior to other catalysts. Fused vanadium pentoxide was found to have the maximum catalytic activity among the various vanadium oxide catalysts studied—fused and unfused, promoted and unpromoted; supported and unsupported. Using the fused catalyst the maximum conversion of *o*-xylene to phthalic anhydride was 61.73% and the selectivity was 86.6% at a temperature of 490°C . air/xylene ratio of 275 and space velocity of 5750.

During the oxidation of xylenes, *ortho*, *meta* and *para*, considerable amount of heat is liberated. Anticipating that these reactions, if carried out under practically isothermal conditions, might lead to improved yield and higher selectivity, they have been studied under fluidised bed with various vanadium oxide catalysts.

The vapour phase oxidation of orthoxylene has been studied in the fluidised bed with vanadium pentoxide catalyst—fused, fused with different proportions of pumice support and unfused supported and promoted catalysts under wide ranges of temperature, air/xylene ratio, space velocity, volume of the catalyst, and concentration of CO_2 in the feed. The products obtained using fused catalysts were mainly phthalic anhydride, *o*-toluic aldehyde and carbon dioxide and traces of quinone whilst in the case of static bed maleic anhydride was present instead of *o*-toluic aldehyde. In the case of unfused catalyst in fluidised bed all the above products were found. Fused vanadium pentoxide gave the maximum yield of phthalic anhydride with high selectivity. Under conditions; $[490^\circ\text{C}]$, air/xylene ratio = 95.1; space velocity = 10,030; volume of the catalyst = 17.3 c.c. (equivalent to 20 gm.) at which maximum conversion to phthalic anhydride was obtained, over the experimental runs given by the authors, the conversion to phthalic anhydride was 67.8% and that to *o*-toluic aldehyde was 3.56% leading to a selectivity of 95%. One interesting feature with fused vanadium pentoxide catalyst in the oxidation of *o*-xylene under fluidised condition was that the yield of phthalic anhydride increased (with increase in concentration of xylene) when the air/xylene ratio was decreased from 2,230 to 102.5 and again fell down when the air/xylene ratio was further decreased to 53.9. Aldehyde yield fell down considerably when air/xylene ratio was reduced. This effect is the reverse of that observed previously in the static bed.²

Similar studies were made with other catalysts and their behaviour was found to be different.

In the case of fluidised bed with fused V_2O_5 under conditions (465°C . air/xylene ratio = 365; space velocity = 9,550) at which maximum conversion to terephthalaldehydic acid and terephthalaldehyde was obtained, over the experimental runs given by the authors, *p*-xylene was converted to the following partial oxidation products to the extent given below:

Terephthalaldehydic acid = 3.12%; terephthalaldehyde = 19.32%; *p*-toluic acid = 2.05%; *p*-toluic aldehyde = 19.91%; maleic anhydride = 20.17%; quinone = 5.18%. In the static bed terephthalic acid was present whilst terephthalaldehyde and terephthalaldehydic acid were absent.

In the case of fluidised bed with fused V_2O_5 under conditions (540°C .; air/xylene ratio = 121.5; space velocity = 9,300), at which maximum conversion to maleic anhydride was obtained, over the experimental runs given by the authors, the *meta*-xylene was converted to the following partial oxidation products to the extent given below: maleic anhydride = 32.68%; *m*-toluic aldehyde = 10.82%; quinone = 0.51%. In the static bed in addition to the above products isophthalic acid was present in traces.

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Indian Institute of Technology,
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May 29, 1959.

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THE PREPARATION OF URANIUM DIOXIDE FROM URANIUM (IV) OXYFORMATE

URANIUM dioxide is generally prepared by the reduction of UO_3 or U_3O_8 with hydrogen¹ or by the action of water vapour on metallic uranium or its hydride² at high temperature. With a view to obtain uranium dioxide by a simple and convenient method at a comparatively low temperature the thermal decomposition of uranium (IV) oxyformate,³ oxyacetate, tetraacetate,⁴ oxyoxalate and oxalate⁵ obtained by photolysis using sunlight was undertaken by the authors. Of these the thermal decomposition of anhydrous oxyformate proved to be the most promising. When UO_2 is heated in air, it is converted to U_3O_8 and thus there is gain in weight. This gain in weight method of analysis has been applied for the determination of uranium dioxide content of

the residue obtained by heating the anhydrous uranium (IV) oxyformate, in vacuum to dull red heat. The data recorded in Table I show that about 90% of the residue is uranium dioxide, the remaining 10% being U_3O_8 .

TABLE I
Analysis of the residue after heating in vacuum to dull red heat
Weight in mg.

Amount of residue	Gain in weight	UO_2 calculated from gain in weight	Percentage of UO_2 in the residue
579.5	21.0	531.6	91.6
674.8	24.0	607.5	90.0

The precise thermo-gravimetric analysis of the compound, which was not possible on account of the want of a thermobalance, in the opinion of the authors, may produce better results and would thus facilitate the preparation of a compound so greatly needed.

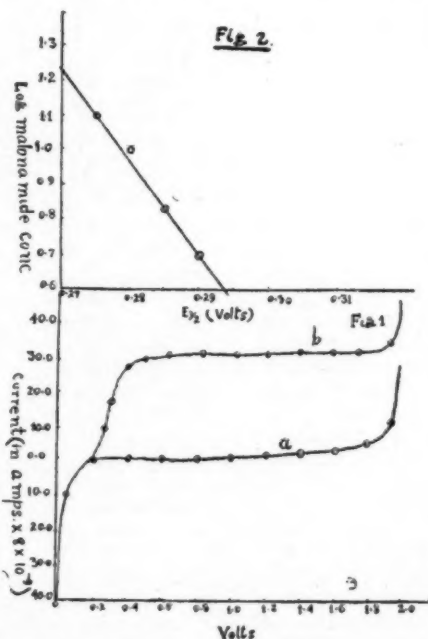
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Utkal University,
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POLAROGRAPHIC STUDY OF THE BIURET-REACTION OF MALONAMIDE

In continuation of our polarographic studies on biuret-reaction,¹ interaction of malonamide with copper sulphate was taken up. Malonamide, a white crystalline product, m.p. 170°C ., was obtained by recrystallising from water the product of the reaction of liquor ammonia on malonic ester. 1.0 M solution of the amide was prepared in doubly distilled water and was diluted with phosphate buffer in order to get the requisite concentrations (0.20 M, 0.15 M, 0.10 M, 0.08 M, 0.04 M). Copper sulphate solution of 1.0 millimolar concentration was used and was obtained by diluting 0.50 c.c. of 0.02 M solution to 10 c.c. by phosphate buffer containing amide of different concentrations. These buffers also acted as supporting electrolytes. Solutions, of pH 11.0, 11.4, 11.6, 11.8,

12.0, obtained by mixing 0.15 M disodium hydrogen phosphate and 0.1 M sodium hydroxide in varying proportions, were used in these experiments.² Polarograms were taken with the help of Fisher Electropode in conjunction with a multiflex galvanometer type MGF₂. Methyl red solution of concentration 0.001% was used as the maximum suppressor. All experiments were carried out at $35 \pm 0.1^\circ \text{C}$. In all thirty polarograms, using a dropping mercury cathode in an inert atmosphere of nitrogen, were studied. Typical curves are shown in Fig. 1.

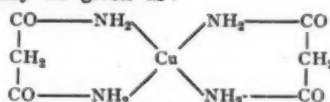


a. Polarogram of supporting-electrolyte.

b. Polarogram of 1.0 millimolar Copper Sulphate in 0.20 M malonamide.

From the polarograms it could be concluded that copper-complex of malonamide is reducible reversibly at the dropping mercury electrode. The reversibility of the electrode reaction was tested by Tomes method.³ The difference of $E_{3/4}$ and $E_{1/4}$ was found to be 0.065 showing thereby that the reaction proceeds with one electron transfer. Plots of $E_{1/2}$ vs. \log concn. of malonamide (vide Fig. 2) gave a straight line with a slope of 0.035. This goes to prove that two molecules of amide take part in the complex formation with one atom of copper.

On this basis the structural formula of the complex may be given as:



Unlike copper-biuret and copper-serine complexes no linear and regular relationship was obtained on plotting $E_{1/2}$ against pH although $E_{1/2}$ values showed a decrease with decrease in pH. The behaviour of the diffusion current was also found to be different. Here the value of the diffusion current was quite different at pH 11.0 and 11.4. A negative deviation from more or less constant values for pH 11.6, 11.8 and 12.0 was observed. This might be due to the decrease in the complexing tendency of malonamide at pH 11.0 and 11.4. Mention may be made of the fact that at pH 11.0 a slight green turbidity was observable.

Further work on the polarography of amides and amino-acid complexes is in progress.

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SYNTHESIS OF δ -(3-ALKYL-4-METHOXYPHENYL)-*n*-BUTYLAMINES

A FEW β -(3-alkyl-4-methoxyphenyl)-ethylamines and γ -(3-alkyl-4-methoxyphenyl)-propylamines were synthesised¹ with a view to testing them for amœbicidal activity. If in the latter type, the amino group is further removed from the nucleus by one more C-atom it will lead to the compounds of the type δ -(3-alkyl-4-methoxyphenyl)-*n*-butylamine (II). It has

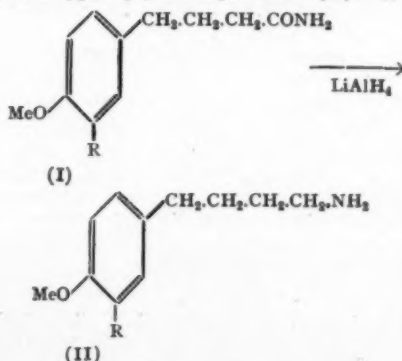
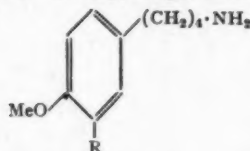


TABLE I
 δ -(3-Alkyl-4-methoxyphenyl)-*n*-butylamine (II)



R =	Cryst. from	m.p.	% yield	Hydrochloride Formula	Found % N	Calc.	Picrate Cryst. from	m.p.
1 CH ₃	.. Ethyl acetate + abs. alc.	184°	60	C ₁₂ H ₂₀ NOCl	6.3	6.1	dil. alc.	118°
2 C ₂ H ₅	.. do.	149°	60	C ₁₃ H ₂₂ NOCl	5.78	5.74	do.	105°
3 <i>n</i> -C ₃ H ₇	.. do.	150°	63	C ₁₄ H ₂₄ NOCl	5.56	5.43	do.	100°
4 <i>n</i> -C ₄ H ₉	.. Ethyl acetate	133°	64	C ₁₅ H ₂₆ NOCl	5.21	5.15	do.	104°

been considered worthwhile to synthesise these and to examine their amebicidal activity.

δ -(3-Alkyl-4-methoxyphenyl)-*n*-butylamines have been obtained by the reduction of appropriate γ -(3-alkyl-4-methoxyphenyl)-*n*-butyramides (I) with LiAlH₄ in dry ether. The amines were directly isolated as hydrochlorides from the ethereal solution. The synthesis of the amides (I, R = Me, Et, *n*-Pr) has already been described¹ whereas the amide (I, R = *n*-Bu) was obtained from *o*-*n*-butylanisole by condensing the latter with succinic anhydride in nitrobenzene in the presence of anhydrous aluminium chloride to yield β -(3-*n*-butyl-4-methoxybenzoyl)-propionic acid (yield 62%, cryst. from dil. alc., m.p. 130°. Found: C, 68.05; H, 7.73. C₁₅H₂₀O₄ requires C, 68.18; H, 7.57%) which by Clemmenson reduction in toluene solution reduced to γ -(3-*n*-butyl-4-methoxyphenyl)-*n*-butyric acid (yield 55%, b.p. 240-45°/13 mm. Found: C, 71.84; H, 8.7. C₁₅H₂₂O₃ requires C, 72.0; H, 8.8%) and subsequent conversion to γ -(3-*n*-butyl-4-methoxyphenyl)-*n*-butyramide (yield 83%, cryst. from dil. alc., m.p. 92°. Found: N, 5.74. C₁₅H₂₃O₂N requires N, 5.62%).

The various constants of the amines (II) are given in Table I.

The authors acknowledge their thanks to Dr. Mata Prasad, Vice-Chancellor, Vikram University, for providing research facilities.

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Ujjain (M.P.), March 19, 1959.

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CAFFEINE AND TANNIN CONTENT OF STALKY TEA

UNDER the Prevention of Food Adulteration Rules,¹ no distinction has been made between dust, leafy and stalky tea in the standard. Only the crude fibre content has been fixed as, "not more than 15%". Stalky tea having high stalk contents is found to pass the prescribed standard of crude fibre. Considering that the flavour of tea largely depends,² on its caffeine and tannin values it would be interesting to find out if any correlation exists between the crude fibre contents and the caffeine and tannin values of stalky tea.

Fifty samples of tea were analysed for crude fibre, caffeine and tannin values. Crude fibre was estimated by standard method,³ by digesting 2 g. tea, first with 200 ml., 1.25% sulphuric acid for 30 minutes, then with 1.25% sodium hydroxide. It was washed with 100 ml., 1% hydrochloric acid and again with alcohol and ether, and dried to constant weight. Caffeine was estimated by the Bailey and Andrew method,⁴ by boiling tea with heavy magnesia, extracting with chloroform and finally drying to constant weight. Tannin was estimated by A.O.A.C. method,⁵ by process of oxidation with potassium permanganate.

TABLE I

Group	Number of samples	Crude fibre range of values	Caffeine range of values	Tannin range of values
A ..	10	5.0-10.1	2.1-2.8	7.0-9.6
B ..	10	10.3-15.0	2.0-2.7	7.0-8.2
C ..	15	15.2-20.0	2.5-3.0	6.1-8.8
D ..	15	20.4-30.4	2.0-2.8	5.2-8.0

The results given in Table I show that there is no correlation between crude fibre contents and caffeine and tannin values of stalky tea. In general, caffeine and tannin values of stalky tea are found low. Also it appears that there is no possibility of incorporating caffeine and tannin contents in the standard, in assessing the purity of stalky tea.

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SOME STYRYL DERIVATIVES OF 4 (3)-QUINAZOLONES AS POTENTIAL FILARICIDES

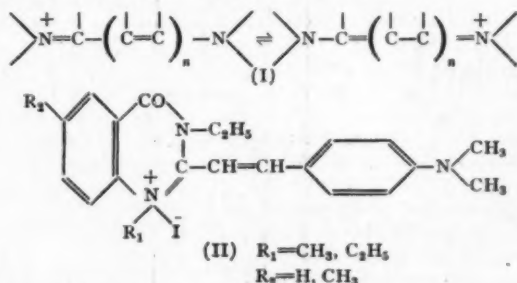
A LARGE number of cyanine dyes and related styryl derivatives have been successfully investigated as filaricides.¹⁻⁵ Amongst these 1'-Ethyl-3 : 6-dimethyl-2-phenyl-4-pyrimido-2'-cyanine chloride was highly active against adult filarial worms in cotton rats although against *W. bancrofti*, the results were less promising. Similarly, 2-p-di-iso-propylamino-styryl-6-methyl-quinoline-methochloride⁴ was found to be the most active amongst several styryl-quinoline derivatives tested.^{4,5} Antifilarial activity in above cases was not restricted to any particular type

methyl-3-ethyl-6-substituted-4 (3)-quinazolone derivatives were synthesised by condensing appropriate acetantranils with ethylamine in ethanolic medium.^{7,8} Alkyl iodides of these 4 (3)-quinazolone derivatives were prepared by heating them with methyl or ethyl iodide in a sealed tube at 110-20° C. for 5-6 hours.⁹ Finally, equimolar quantities of 2-methyl-3-ethyl-6-substituted-4 (3)-quinazolone alkyl iodides were condensed with p-dimethyl-amino-benzaldehyde in presence of acetic anhydride¹⁰ and the final products crystallised from absolute methanol as red dyes. The following have been synthesised :—

- (a) 2-p-Dimethylamino-styryl-3-ethyl-4 (3)-quinazolone-ethyl iodide; orange-red needles, m.p. 212° C. (Found N, 8.83; $C_{28}H_{26}ON_3I$ requires N, 8.84%).
- (b) 2-p-Dimethylamino-styryl-3-ethyl-6-methyl-4 (3)-quinazolone, methyl iodide; purple-red needles, m.p. 258-60° C. (Found N, 9.07, $C_{22}H_{30}ON_3I$ required N, 8.84%).
- (b) 2-p-Dimethylamino-styryl-3-ethyl-6-methyl-4 (3)-quinazolone-ethyl iodide; orange-red granules, m.p. 218° C. (Ultra-violet absorption H_2O Max. 225 mμ) (Found N, 8.81, $C_{23}H_{28}ON_3I$ requires N, 8.59%).

Further work is in progress.
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of ring structure but was basically associated with the presence of an amidinium ion system (I), in which a positively charged quaternary nitrogen was linked to a tertiary nitrogen by a conjugated chain of at least three carbons in length.⁶

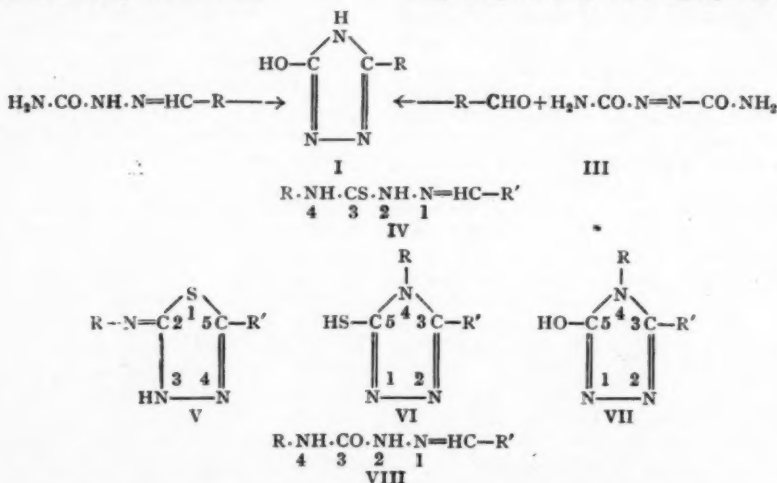
In view of the above hypothesis, some 2-p-dimethyl-aminostyryl-3-ethyl-6-substituted-4 (3)-quinazolone-alkyl iodides (II) have now been synthesised as potential filaricides. Firstly, 2-

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AN IMPROVED OXIDATION PROCEDURE FOR THE PREPARATION OF 5-HYDROXY-4, 1, 2-TRIAZOLES

SUITABLY substituted 4, 1, 2-triazoles have been reported to possess interesting physiological properties.¹⁻³ 5-Hydroxy-4, 1, 2-triazoles (I), present in addition interesting structural problems. Methods available hitherto for the synthesis of these triazoles involve the heating of aldehyde semicarbazones (II) with an alcoholic solution of ferric chloride in a sealed tube,⁴ or the treatment of aldehydes and azodicarbamides (III) with ferrous chloride likewise,⁴ both procedures being cumbersome.



During the course of a detailed study on the reactivity of thiosemicarbazones (IV), we had occasion to note that 4-aryl thiosemicarbazones on oxidation with potassium ferricyanide and alkali yielded, in addition to the reported 2-arylimino-5-aryl- Δ^4 -1, 3, 4-thiadiazolines (V),⁵ small quantities of higher melting, alkali-soluble substances in some cases. On the basis of the earlier observations of Young and Eyre,⁶ it was first suspected that these products may be 5-mercapto-3, 4-diaryl-4, 1, 2-triazoles (VI). However, the absence of sulphur and their analytical data indicated them to be 5-hydroxy-3, 4-diaryl-4, 1, 2-triazoles (VII),

arising from the thiosemicarbazones (IV) by desulphurisation caused by alkaline ferricyanide.

The product obtained by the acidification of the filtrate from the oxidation of 1-benzal-4-phenyl thiosemicarbazone with potassium ferricyanide and alkali was found to be identical with 5-hydroxy-3, 4-diphenyl-4, 1, 2-triazole (VII; R and R' = phenyl), prepared by heating 1-benzal-4-phenyl semicarbazone (VIII; R and R' = phenyl) with ferric chloride in a sealed tube at 130° C. for one hour.^{7,8}

This incidental observation led to the interesting finding that 4-aryl semicarbazones (VIII), the sulphur-free analogues of 4-aryl thiosemicarbazones, could be smoothly and readily converted in high yields by heating with potassium ferricyanide and alkali on a water-bath for about an hour, to 5-hydroxy-3, 4-diaryl-4, 1, 2-triazoles. Compared with the previously available methods, the present one appears to be superior, proceeding to completion at ordinary temperatures, with high yields of uncon-

taminated products. The results obtained in a typical set of experiments are summarised in Table I.

TABLE I

Semicarbazone oxidised (VIII)		Hydroxy triazole obtained (VII)	
R	R'	% yield	Melting point °C.
1 Phenyl	.. Phenyl	96	256*
2 do.	.. <i>p</i> -Methoxyphenyl	94	240
3 do.	.. <i>m</i> -Nitrophenyl	91	219
4 <i>p</i> -Tolyl	.. Phenyl	72	244
5 do.	.. <i>p</i> -Methoxyphenyl	81	216
6 do.	.. <i>m</i> -Nitrophenyl	74	251

* Compound reported in literature 7, 8.

Extension of this reaction to a variety of semicarbazones has also been achieved. Full details will be published elsewhere.

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THYROID GLAND IN OPHICEPHALIDÆ (ACTINOPTERYGII, PERCOMORPHI)

In *Ophecephalus striatus* a new structure has been described by Das and Saxena,^{1,2} lying on the floor of the anterior region of the pharynx and surrounding the ventral aorta along most of its length. They named it as 'subpharyngeal sinus'. According to these authors the 'sub-pharyngeal sinus' is a venous sinus and part of the blood vascular system of the fish. The 'sub-pharyngeal sinus' of Das and Saxena is in reality the thyroid gland of the fish.

In *Ophecephalidæ* the thyroid gland is a compact structure and is enclosed by a thin capsular wall of connective tissue, unlike that in the majority of teleost fishes where follicles are unencapsulated and dispersed individually or in clusters around the roots of afferent branchial arteries. It has been described³ in a number of fishes, viz., *Galeichthys felis*, *Gymnarchus niloticus*, *Thynnus thynnus* and several members of the family Sparidae.

Sections of *O. striatus* through the region of ventral aorta (Fig. 1) show the thyroid gland

surrounding the ventral aorta. It is seen to consist of thyroid follicles and blood capillaries. A similar condition is noticed in *O. punctatus* and *O. gachua*.

The presence of a compact thyroid gland in *Ophecephalidæ* might be associated with the air breathing habit. It is quite possible that the thyroid gland acts here as a thermoregulator in order to adapt the fish to a semi-terrestrial environment of low thermal capacity.

The detailed structure and physiology of this gland in *Ophecephalus* will be published elsewhere by one of the authors (Belsare, D. K.).

The authors are grateful to Prof. D. S. Srivastava for research facilities and encouragement.

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MICRONUCLEAR VARIATION IN RACES OF BLEPHARISMA UNDULANS STEIN

Blepharisma undulans is apparently of wide distribution and occurs in the form of a number of races. Suzuki¹ on the basis of macronuclear characters has identified three races, *B.u. americanus*, *B.u. japonicus* and *B.u. undulans*. Recent collections from India have shown that we have in this country animals which belong to two more races. Due to the courtesy of Dr. A. C. Giese and Dr. S. Suzuki we have now in our laboratory all the five races of *B. undulans*, the three described by Suzuki as well as two local ones. An examination of these has convinced us that these five races are quite distinct from one another and differ in a number of characters like size, peristome length, macronuclear form, amount of pigment and its reactions as well as details of life-history.²⁻⁵ We are engaged in this laboratory on comparative studies of the various aspects of these animals.

It is perhaps worth while to make a brief report here of the micronuclei in these five races. We found them as small circular bodies close to the macronucleus in the cytoplasm. The number varies from 8 to 20 in all the races except in *B.u. undulans*, where they tend to be fewer. We have rarely come across a specimen

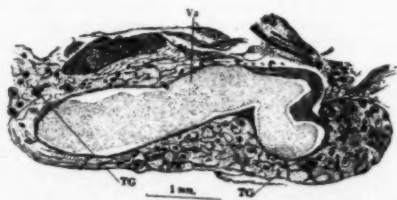
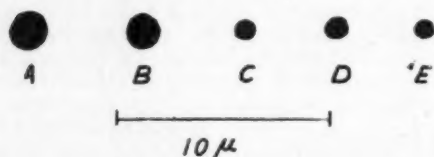


FIG. 1. Camera lucida sketch of the ventral aorta (Va) and the thyroid gland (TG) of *Ophecephalus striatus*, in longitudinal vertical section.

belonging to this race with more than six micronuclei. But it is the size of micronucleus that is of special interest. Figure 1 shows the outlines

Sections (10μ) stained in Feulgen's stain were also examined.



of micronuclei of the five races. A and B are Indian races, C is *B.u. americanus*, D is *B.u. japonicus* and E is *B.u. undulans*. The micronuclear size in Indian races is apparently very large as compared with European, Japanese and American forms. While the significance of this difference is being investigated, the micronucleus forms an additional diagnostic feature of the races *B. undulans*.

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CHROMOSOME COMPLEMENT AND MEIOSIS IN AN ELATERID BEETLE, *AGRYPNUS FUSCIPES* FABRICIUS (COLEOPTERA: ELATERIDAE)

Meiosis in the members of the family Elateridae of the insect order Coleoptera has been reported earlier by Stevens^{1,2} and recently by Smith.³ While listing the chromosome number and sex determining mechanisms in nearly 340 species of Coleoptera belonging to different families and subfamilies, Smith⁴ has also referred to 35 species of Elateridae. All these species belong to the subfamilies Pyrophorinae, Elaterinae and Cardiophorinae. As for the Indian Coleoptera the information is very meagre. Asana *et al.*⁵ and Bose⁶ have recorded a few species.

The material *Agrypnus fuscipes* Fabricius, belonging to the family Elateridae, was collected from Ballygunge, Calcutta, in June 1958. Testes, dissected out from living males, were prepared according to the aceto-carmine squash method.



Figures have been drawn with the help of a camera lucida at a magnification of $\times 1,500$. FIG. 1. Spermatogonial metaphase stage. FIG. 2. Early prophase stage showing the heteropycnotic sex chromosome. FIG. 3. Diakinesis stage. FIG. 4. Metaphase I with the bent and faintly stained X chromosome (polar view). FIG. 5. Metaphase II with the bent X chromosome (side view). FIG. 6. Metaphase I showing the X chromosome located ahead of the autosomes. FIG. 7. Anaphase I. FIG. 8. Telophase I with the lagging X chromosome. FIG. 9. Metaphase II with eight chromosomes. FIG. 10. Metaphase II with nine chromosomes.

Spermatogonia.—Seventeen chromosomes are present in the spermatogonial metaphase stage. The chromosomes can be classified as six large, ten medium and one small (Fig. 1). The smallest element is the single X chromosome. All the chromosomes at this stage appear spherical in shape. The elements at this stage are so condensed that the position of the centromere remains obscure. The nature

of the spermatocyte chromosomes, however, suggests that they are all acrocentric.

Meiosis:—In the early prophase stages of the spermatocyte division the sex chromosome is seen as a deeply stained body usually located near the nuclear membrane (Fig. 2). At diplotene the bivalents have usually a single chiasma. The sex chromosome at this stage is a little more deeply stained than the autosomal bivalents. At diakinesis all the eight bivalents and the single X chromosome stain with equal intensity. The chiasma frequency at this stage is very low (Fig. 3). At metaphase of the primary spermatocyte division nine chromosomes are present. The sex chromosome generally lies at the centre of the spindle surrounded by the autosomes. Some bivalents at this stage exhibit interstitial chiasma. The X chromosome at this stage stains very poorly. It appears that the X chromosome exhibits a gradual decondensation as the spermatocyte stages proceed. This process actually starts at diakinesis. Moreover, the sex chromosome is bent like a hook at one end. Both the autosomes and the sex chromosomes orientate on the equator lying parallel to the axis. The sex chromosome is generally placed a little ahead of the autosomes towards one of the poles (Figs. 4, 5 and 6). The sex chromosome and the autosomes segregate at anaphase I, undivided to the poles, thereby one pole is with the X chromosome and the other without it (Fig. 7). In several anaphase cells the sex chromosome is found lagging on the spindle. Thus, it is very interesting to note that the X chromosome which initially started with a precocious movement ultimately becomes the last element to reach the pole (Fig. 8). As a result of prereduction of the X chromosome at anaphase I, two types of metaphase II cells are formed and they are with nine and eight chromosomes, the former type is with the single X chromosome (Figs. 9 and 10). Anaphase II is simple and typically mitotic. Two types of secondary telophase nuclei, thus formed are, one with the sex chromosome, and the other devoid of it. The male determining sperms have eight chromosomes and the female determining sperms are with nine chromosomes.

This work has been done under the supervision of Dr. S. P. Ray-Chaudhuri. The author also expresses his thanks to Dr. A. P. Kapur, Zoological Survey of India, Calcutta, for kindly identifying the material used here.

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OCCURRENCE OF *GLANDICEPS* SP. AND *SACCOGLOSSUS* SP. (ENTEROPNE- USTA) FROM THE INSHORE WATERS AT PORTO NOVO

MENON¹ recorded the occurrence of *Glandiceps coramandelicus* Spengel and *Saccoglossus bournei* Menon from Madras. Rao² described a second species, *Glandiceps stiasnyi* Rao, from young worms obtained by rearing *Tornaria*. Rao³ further reported the occurrence of *Saccoglossus madrasensis* Rao, *Glossobalanus minutus* Kowalevsky and five varieties of *Ptychodera flava* Eschscholtz from Madras and the Gulf of Mannar.

Tornaria larvae are commonly present in the plankton during January to March in the inshore waters at Porto Novo and also in the Marine Zone of the Vellar estuary, but the occurrence of the adults in these regions was not known till recently. The Marine Biological Station, Porto Novo, has been conducting regular cruises on the inshore waters of the Bay of Bengal. During one of these cruises in March this year, a single young live specimen of Enteropneusta, provisionally identified as *Glandiceps* sp., was dredged at 10 fathoms, about four miles from the shore. Again more recently another single specimen of Enteropneusta identified as *Saccoglossus* sp. was dredged at another station, also at 10 fathoms. The overall length of this specimen was 10.6 mm., the proboscis alone measuring 5.6 mm. A systematic search is in progress to determine the area of distribution of these species.

Glandiceps sp. occurs in a region where the bottom sediment consists of about 56% clay and silt, 11% very fine sand, 16% fine sand, 9% medium sand, 7% coarse sand and nearly 1% very coarse sand, and *Saccoglossus* sp. in a substratum composed of 39% silt and clay, 10% very fine sand, 8% fine sand, 12% medium sand, 18% coarse sand and 13% very coarse sand.

Further investigations are in progress and a detailed account will be published elsewhere.

My thanks are due to Prof. R. V. Seshaiya, Director, Marine Biological Station, Porto Novo, and to the other Officers of the Station for help

and encouragement and to the Government of India for a Senior Research Scholarship.

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HERITABILITY AND REPEATABILITY OF MILK YIELD IN MALVI CATTLE

ESTIMATES of heritability for milk yield in European cattle have been recorded by Laben *et al.* (1950)² and Randel *et al.* (1957)³. Amongst the Indian cattle similar values for Harijana breed have been reported (Krishnam, 1956).¹ There is, however, no record of similar estimate of heritability of milk yield for Malvi cattle.

Data on milk yield of 1st and 2nd lactations of 44 daughter-dam pairs were collected from Government Cattle Breeding Farm, Agarpura. Milk yield was calculated for 300 days for all the animals.

Estimates of heritability and repeatability were determined by the methods already described (Taneja, 1955, 1958).^{4,5}

TABLE I

Heritability of milk yield in Malvi cattle for daughter-dam comparison

Character	d.f.	x_D^2	$x_D x_d$	b_{Dd}	h^2	S.E.	't' value
Milk yield	42	626164.2	135325.8	0.216	0.43	0.10	2.05*

* Significant at 5% level.

D = dam, d = daughter.

Results in Table I indicate that the regression of daughter (d) on the dam (D) for milk yield is statistically significant. Heritability was calculated to be 0.43 ± 0.20 .

TABLE II

Analysis of variance

Source of variation	d.f.	M.S.	'F' value
Between lactations	.. 1	77831.7	1.24
Between animals	.. 43	452823.9	7.23†
Residual	.. 43	62670.3	..

† Significant at 1% level.

Results in Table II indicate highly significant differences between animals ($F = 7.23$; $P1\% = 7.26$). Repeatability was estimated to be 0.76 ± 0.20 .

The estimate of heritability for milk yield in this breed is considerably high and mass selection can be practised to raise the milk production. The genetic improvement (ΔG) in the next generation depends upon selection differential (S.D.) and the heritability (h^2) since,

$$\Delta G = S.D. \times h^2.$$

Therefore, with higher estimate of heritability as found in this study, even less intense selection will be effective for improving the milk yield.

Just as the heritability determines the improvement in the next generation, repeatability determines gain in the future records of the selected group in that generation. The estimate of repeatability for milk yield in this study is considerably high, and is an important aid to selection.

We have great pleasure in expressing our indebtedness to Dr. R. L. Kaushal, Principal and Joint Director, Research, for his advice, guidance and continued interest in this investigation.

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OCCURRENCE OF A TENUIPALPID MITE ON GUAVA FRUITS IN MYSORE

A SERIOUS injury on fruits of guava (*Psidium guajava*) and to a lesser extent on citrus fruits was noticed on the Horticultural Farm at Maddur (Mysore State). The affected fruits showed brownish scalded patches on the surface, which in severe cases covered the entire surface and even resulted in splitting of the apical portion of the fruits (Fig. 1). These fruits, on close examination under a binocular microscope, revealed a reticulated pattern of fissures on the surface. A large number of a species of red mite was also seen, mainly concentrating along the fissures. All stages of the mite (egg, larva, nymphs and adult) were noticed. The females predominated, males being rarely encountered.

The mite has been tentatively identified as *Brevipalpus* sp. (Tenuipalpidae). There appears to be no record of the genus in India.

Brief descriptions of the different stages of the mite are given here:

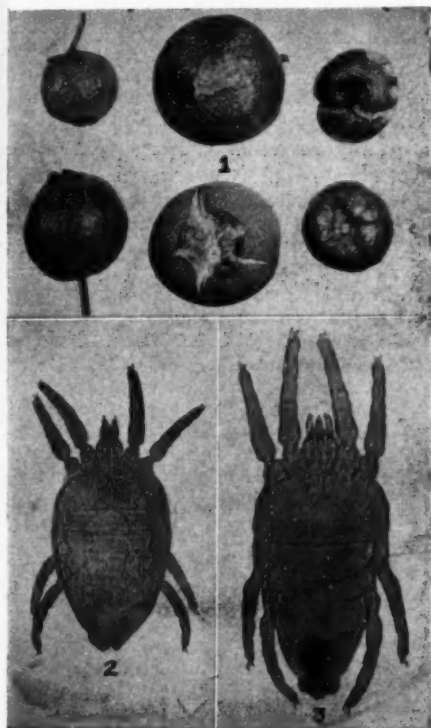


FIG. 1. Guava fruits showing typical damage caused by *Brevipalpus* sp.

FIG. 2. *Brevipalpus* sp., adult female, $\times 19$.

FIG. 3. *Brevipalpus* sp., adult male, $\times 27$.

Adult female (Fig. 2): Almost inverted pear-shaped in outline; flat, red, with the four pairs of legs and the anterior and the posterior ends of the body paler. Body divided into 3 distinct portions, gnathosoma, propodosoma and hysterosoma by transverse sutures. Dorsum with fine reticulations. Length (from the tip of the rostrum to the tip of the hysterosoma): $284 \pm 10 \mu$. Width (in the widest region): $136 \pm 10 \mu$.

Adult male (Fig. 3): Same as the adult female, but with the posterior end a little more tapering and with the hysterosoma further divided into metapodosoma and opisthosoma by a transverse suture.

Length: $257 \pm 16 \mu$.

Width: $121 \pm 5 \mu$.

Deutonymph: Red, oval, and flat; with four pairs of legs.

Length: $220 \pm 10 \mu$.

Width: $120 \pm 5 \mu$.

Egg: Red, elliptical in outline.

Length: $100 \pm 5 \mu$.

Width: $63 \pm 2 \mu$.

Further work on the identity, host range, etc., of this species is in progress.

M. PUTTARUDRIAH.

G. P. CHANNA BASAVANNA.

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CHROMOSOME NUMBER IN *ARNEBIA HISPIDISSIMA* (LEHM.) DC.

For this study the flower-buds were fixed in 1:3 acetic alcohol for meiotic studies. Smear preparations from young leaf tips were made following the usual aceto-orcein technique.

The pollen mother-cells at diakinesis and metaphase I showed four bivalents (Fig. 1). The disjunction of chromosomes at anaphase I was regular, four chromosomes being clearly visible at either pole (Fig. 2). Other stages of the first meiotic division were quite normal and indicated four to be the haploid chromosome number of the species. The somatic chromosome number was found to be $2n = 8$ as determined from a number of well spread metaphase plates (Fig. 3). Based on the size difference, the somatic chromosomes can be divided into three groups: (i) one pair of long chromosomes, (ii) two pairs of medium sized chromosomes, and (iii) one pair of short chromosomes.



FIGS. 1-3 ($\times 1,420$). Fig. 1. Metaphase I (polar view) showing four bivalents. Fig. 2. Anaphase I with four chromosomes at either pole. Fig. 3. Somatic metaphase plate showing eight chromosomes.

As far as the authors are aware, the chromosome number of *Arnebia hispidissima* (Lehm.) DC. has not been reported so far. Our observations clearly indicate four to be the haploid number of this plant. It will be interesting to note that the only other plant in the family Boraginaceae with $n=4$ is *Amsinckia lunaris*.¹ It may be mentioned here that four is the lowest haploid chromosome number so far encountered in the family Boraginaceae.¹

The authors are grateful to Principal Dr. A. N. Banerji, for the facilities and encouragement. Department of Botany, C. P. MALIK.
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OCCURRENCE OF THE GENUS *SCOLECOBASIDIUM* ABBOTT IN INDIA

ABBOTT¹ isolated two new fungi from cotton and sugarcane soils from Louisiana. The distinguishing characters of these fungi were the shape and method of production of conidia on the conidiophores. Depending on the presence of thread-like nature of the sterigmata or basidia in both the cases, he proposed *Scolecobasidium* as the generic name, and since the conidial structures in both the isolates were different, he proposed *S. terreum* and *S. constrictum* as its species.

During the course of investigation on soil fungi of grasslands of Varanasi, the author isolated the same two species with some difference in characters from two different grass plots and which, to the knowledge of the author, have not been described so far excepting *S. constrictum* reported from soil of Georgia by Miller et al.²

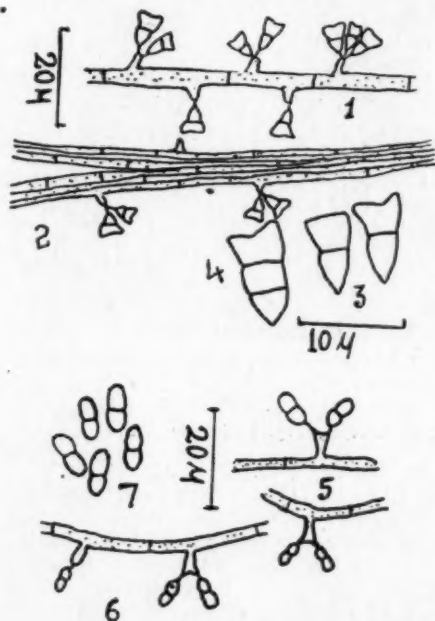
S. terreum was isolated at the depths between 7-12" from an alkaline grassland. The main grasses which compose this grassland during the rainy season and which come first in the order of frequency and dominance are *Setaria glauca* Beauv., *Cynodon dactylon* Pers., *Dicanthium annulatum* Stapf. and *Oplismenus burmannii* Beauv. Other herbaceous weeds which grow mixed along with these grasses are *Dactyloctenium aegyptium* Willd., *Cassia tora* Linn., *Evolvulus alsinoides* Linn., *Euphorbia hirta* Linn., *E. thymifolia* Linn., *Heliotropium supinum* Linn., *Polygala chinensis* Linn., and *Desmodium*

triflorum DC. The pH, moisture content and colour of the soil at this depth are 8, 15% and light-brown-grey respectively.

S. constrictum was isolated at the depths between 13-18" from a grass plot with *Saccharum spontaneum* Linn., *Dicanthium annulatum* Stapf. association. The other weeds growing along with these grasses are *Evolvulus alsinoides* Linn. and *Polygonum plabejum* Br. The PH, moisture content and colour of the soil at the depth are 7.5, 19% and light-brown respectively.

Scolecobasidium terreum Abbott

Colonies on oatmeal agar medium growing very slowly at 25°C., at first almost entirely submerged but later on developing sub-aerial hyphae, greyish-black or dusky-brown, reverse of colonies brownish-black, resembling *Broncho* Old English Brown (Maerz and Paul,³ Pl. 8, 12 E); hyphae septate, single or funiculose, olive yellow (Pl. 12, L₂); conidiophores arising as side branches from hyphae, 3.6-7.2 μ long



FIGS. 1-4. *Scolecobasidium terreum* Abbott. Fig. 1. Attachment of conidia on conidiophores. Fig. 2. Funiculose hyphae. Fig. 3. T- and Y-shaped conidia. Fig. 4. Three-celled conidium.

FIGS. 5-7. *Scolecobasidium constrictum* Abbott. Fig. 5. Attachment of conidia on angular apices of the conidiophores. Fig. 6. Hyphae bearing conidiophores with rounded and angular apices. Fig. 7. Conidia.

and 2-2.7 μ broad; conidia T or Y-shaped, born at the tip of conidiophores attached by thread-like sterigmata, light olive-yellow to almost hyaline, smooth, 2-celled, 4.8-12.6 \times 2.4-3.2 μ ; sterigmata 0.5-1.0 μ long. Out of many, only three conidia were seen with three cells.

The fungus tallies with the type description in the method of production and structure of conidia but differs in bearing funiculose hyphae.

Scoleobasidium constrictum Abbott

Colonies on oatmeal agar growing very slowly at 25° C., round, surface greyish-black: reverse greenish-black; hyphae at first submerged, later on producing dusky sub-aerial hyphae, olive-yellow (Pl. 12, L₂), septate; apices of the conidiophores of two types, viz., round and angular, conidiophores 3.6-7.2 \times 2-2.7 μ ; sterigmata 0.5-1.0 μ long; conidia oblong, slightly constricted at the centre, smooth, light olivaceous to almost hyaline, 5.4-14.4 \times 2.7-3.6 μ .

The isolate agrees with the description given by Abbott¹ in every respect excepting the conidiophores which are of two types as mentioned above.

The author is grateful to Dr. R. Y. Roy for his guidance and criticism, to Prof. R. Misra, Head of the Department of Botany, for providing laboratory facilities and to the Government of India, for the award of a Scholarship.

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Banaras Hindu University,
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OCCURRENCE OF *HELMINTHOSTACHYS ZEYLANICA* HOOK. IN GORAKHPUR

Helminthostachys zeylanica Hook. has been found to occur in some swampy areas of western forest of South India up to an elevation of 3,000 feet and also in Bengal and Assam.¹ As far as we are aware, this monotypic genus has not been reported from any part of Uttar Pradesh or its adjoining areas.

Recently, while studying the vegetation of Gorakhpur and its neighbourhood, a good growth of this plant was found in a swampy area of Kushmi forest (83° 25'-83° 30' E, 26° 40'-26° 50' N) seven miles east of Gorakhpur City. The swamp (pH of soil = 8) is characterized by the presence of a belt of wild *Eugenia heyneana* trees with which the fern has

been found to be closely associated. Another species found growing with these almost constantly is *Smilax prolifera*.

The specimen essentially conforms to the description given for *Helminthostachys zeylanica* by Beddome except for a high degree of variation in the form of the abaxial sterile portion of leaf which is ternately compound.² The leaflets vary from a simple and undivided condition to one with a highly dissected type (Fig. 1). The commonest type met with shows



FIG. 1. Sterile segment of leaf showing variation, $\times 1/5$, the central leaflet divided into three and the laterals each into two lobes. The successive leaves produced by the same plant are similar to each other, however. The adaxial fertile portion does not show such variations.

A cross-section of the rhizome shows a medullated protostele with phloem masses wedged profusely in xylem elements. There is a clear endodermis demarcating the stele from the cortex. Most of the parenchymatous cells are richly laden with food materials. The rachis shows a dictyostele with short, more or less 'C'-shaped, meristeles. At its higher level the meristeles elongate tangentially and in the basal parts of the leaflets they may be highly elongated.

We are thankful to Prof. K. S. Bhargava for facilities.

Department of Botany, S. K. ROY.
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Gorakhpur (U.P.),
February 1, 1959.

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THE EFFECT OF PLANT REGULATORS ON SEX EXPRESSION IN RIBBED GOURD (*LUFFA ACUTANGULA* ROXBG.)

PLANT regulator treatments are known to influence greatly the sex expression in cucurbitaceous plants, leading to either suppression of the male flowers or increase in the number of female flowers per plant; in cucumber α -naphthalene acetic acid (NAA), β -indole acetic acid (IAA) and 2,4-dichlorophenoxy acetic acid (2,4-D) were found to suppress male flowers and promote female flowers.¹⁻³ In watermelon male sterility was induced by 2,4-D or tri-iodo-benzoic acid, without affecting the female flowers.⁴ The present investigations were undertaken with a view to study the effect of some plant regulators on the sex expression of ribbed gourd (*Luffa acutangula* Roxbg.).

NAA, 2,4-D and *p*-chlorophenoxy acetic acid (CIPA) were selected for the purpose. The seeds of ribbed gourd were sown in the field. The plants were sprayed with the plant regulators in aqueous solutions at regular intervals, starting from the seedling stage. Observations on the date of first flowering and the number of male and female flowers produced on each plant were made at periodical intervals. There were four plants under each treatment and the average data on the flowers and fruit set are presented in Table I.

TABLE I

The effect of whole plant sprays of plant regulators on sex expression and fruit set in ribbed gourd

(Average of four plants)

Treatment	First flowering after: days	Total no. of flowers	% female flowers	Total fruit set
Control 0 p.p.m.	38	952	2.9	16
NAA: 0.05 p.p.m.	42	874	4.0	16
25.0 p.p.m.	45	582	6.9	19
2,4-D: 0.05 p.p.m.	37	702	5.5	18
25.0 p.p.m.	41	416	8.2	21
CIPA: 0.05 p.p.m.	82	367	6.3	15
25.0 p.p.m.	93	198	9.1	25

Due to the spray treatments there was a reduction in the total number of flowers per plant, the maximum reduction of 80% being caused by 25 p.p.m. of CIPA. The chemicals also seem to alter the sex expression, which is mainly due

to a reduction in the number of male flowers per plant, thus causing an increase in the percentage of female flowers. There was considerable delay in flowering due to the CIPA treatments. The spray treatment with 25 p.p.m. of 2,4-D also caused the formation of male and female flowers in a cluster (the female ones also having bracteoles like males) as against the solitary female flowers in the control plants (Fig. 1); the bracteoles at the base of the pedicels of the male flowers were transformed into leafy structures (Fig. 2).

Thus there seems to be evidence in the present studies to suggest that a mechanism of hormonal type is involved in sex determination in ribbed gourd. These results are in agree-

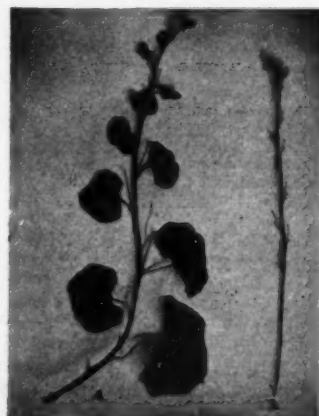
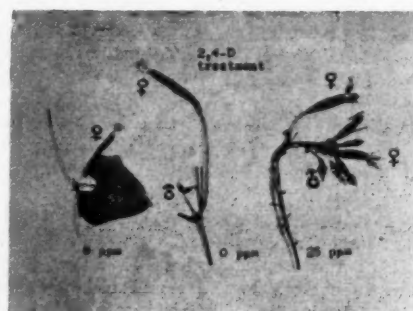


FIG. 1. Effect of whole plant sprays of 2,4-D (25 p.p.m.) on sex expression in ribbed gourd: cluster bearing of female flowers together with male flowers as against single female flowers in the control.

FIG. 2. A. Modification of bracteoles in the male panicle into leafy structures due to whole plant sprays of 2,4-D; B, normal panicle from control plant.

ment with the findings of Laibach and Kribben¹ in cucumber with NAA.

Dept. of Agriculture, G. SATYANARAYANA.
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ON THE PECULIARITY IN THE CONJUGATION OF *SPIROGYRA* *PUNCTULATA* JAO.

THE object of this note is to record a peculiarity in the conjugation of *Spirogyra punctulata* Jao¹ and the formation of triploid zygospores in nature. The material was collected from a freshwater stream at the foot of hills in Jalukbari, Assam, during the month of February, 1959, and identified by Mr. G. S. Venkataraman.

Vegetative cells 76-84 μ broad, 114-334.4 μ long; chloroplast 3-4, making 0.5-1 spiral; end walls plane; conjugation scalariform, tubes formed by both the gametangia; zygospores formed in the female gametangia; gametangia cylindric; zygospores elliptic with pointed ends, 68.4-79.8 μ broad, 95-121.6 (-155) μ long, brown when mature, exospore smooth, colourless, mesospore punctate. In the type material Jao¹ describes the zygospores as yellow but in the present form the mature zygospores are brown in colour.

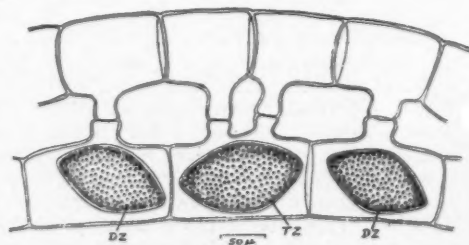


FIG. 1. Conjugating filament of *Spirogyra punctulata* Jao showing normal and abnormal type of scalariform conjugation (Dz, Diploid zygospore; Ts, Triploid zygospore).

In the normal scalariform conjugation, a single conjugation papilla is formed, one from the male and the other from the female gametangium and these two papillae fuse and open into one another. Besides this normal type of

conjugation, an abnormal mode of sexual fusion was observed. Here two male gametangia fused with a single gametangium (Fig. 1). In such cases two conjugation papillae, instead of one were formed from a single female gametangium, and these fused with the other two papillae, formed one from each corresponding male gametangium. Thus the resulting zygospores are likely to be triploids, instead of the normal diploid ones. There is, however, no morphological difference between the diploid and triploid zygospores.

The author records his sincere thanks to Prof. H. K. Baruah for his interest and encouragement and to Mr. G. S. Venkataraman for his suggestions and for identification of the material.

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A NEW BACTERIAL LEAF-SPOT OF *CROTALARIA JUNCSEA* L.

THE leaves of *Crotalaria juncea* L. (Sunn-hemp) with round water-soaked spots of about 1 to 3 mm. in size, surrounded by a distinct halo, were collected in August 1958 from the Institute of Agriculture, Anand. In the early stage these spots have a dark brown centre surrounded by a halo and as the spots enlarge the centre becomes whitish with a dark brown margin surrounded by a halo. The number of spots on each affected leaf varied from one to several (Fig. 1). Under favourable condition,

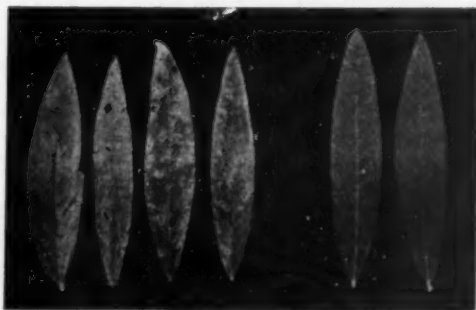


FIG. 1. Typical symptoms on leaves of *Crotalaria juncea* L. incited by *Xanthomonas patchii* Desai and Shah

in advance stage of disease development, the spots become irregular and coalesce involving major portion of the leaf. The lower leaves were found to be affected first and defoliate prematurely in severe cases. In some cases the tissues from the central portion of the spot become separated forming a shot hole.

Microscopic examination of several spots revealed masses of bacteria oozing out from the lesions (Fig. 2).



FIG. 2. Bacteria oozing out from the lesion.

On isolation, shining yellow-coloured colonies were obtained on Potato Dextrose Agar. The cultures thus obtained were purified and inoculated in leaves of sunn-hemp. The typical spots were developed on the leaves in ten days.

The organisms are short rods, gram negative, no spore, non-acid fast and motile by single polar flagellum. The size of bacteria varies from 1.18 to $1.64 \mu \times 0.54$ to 0.82μ .

Colonies on Potato Dextrose Agar are citron yellow, circular with entire margins, smooth, convex, glistening and butyrous; odour absent and colour of the medium unchanged. Nitrates not reduced, indole and ammonia not produced. Hydrogen sulphide produced and starch and casein hydrolysed.

The organism could incite spots on leaves of *Crotalaria juncea* L. but not on the leaves of *Desmodium diffusum* DC., *Vigna catjang* Walp., *Dolichos lablab* L., *Cajanus cajan* L. Millsp., *Gossypium hirsutum* L. and *Phaseolus vulgaris* L. It is, therefore, proposed to name the organism as *Xanthomonas patellii* sp. nov. after Dr. M. K. Patel who has significantly contributed to the knowledge of bacterial plant diseases.

Further work is in progress and will be reported elsewhere.

Dept. of Plant Pathology,
Institute of Agriculture,
Anand, April 17, 1959.

M. V. DESAI.
H. M. SHAH.

CHROMOSOME MORPHOLOGY AND MEIOSIS IN *SMILACINA PALLIDA*

EARLIER cytological studies on this liliaceous genus have been made by Tahara,¹ Sato² in *Smilacina japonica*; Stenar³ in *S. racemosa*; Cave⁴ in *S. sessilifolia*; Rattanbury⁵ in *S. amplexicaulis*. Recently Therman⁶ investigated *S. racemosa*, *S. trifolia* and *S. stellata*. All these investigators have reported the chromosome number $2n = 36$ for the species studied.

Therman⁶ is of the opinion that the centre of origin of the entire tribe Polygonatæ, to which this genus belongs, lies in Eastern Asia. Little work has so far been done on the species occurring in this region. Hooker³ has described four species, *S. fusca*, *S. oleracea*, *S. oligophylla* and *S. pallida* occurring in Himalayas. Of these, only *S. pallida* Royle is distributed throughout the Himalayan range, the rest being restricted to Eastern Himalayas. Material collected from Narkanda, Simla hills, in Western Himalayas was used by the writer for cytological studies. The procedure followed consists in treating freshly cut root-tips in α -Bromonaphthalene for 1-2 hours, followed by smearing in acetocarmine, after mild hydrolysis in N HCl. Meiosis has been studied from PMC-anthers smeared in acetocarmine after fixation in Carnoy's fluid.

Somatic chromosome number $2n = 36$ and haploid number $n = 18$ has been noted (Fig. 1). The karyotype is asymmetrical consisting of short, medium and long chromosomes. The shortest chromosome measures 3.25μ and longest chromosome 12.25μ . There are three long chromosomes with nearly median constriction, and of these, one pair has a secondary constriction in the short arm. Eleven medium-sized chromosomes are present, and of these, two pairs show median or nearly median primary constriction and nine medium-sized chromosomes have subterminal primary constrictions. One pair of dissimilar medium-sized chromosome bears secondary constriction in the short arm. There are seventeen short chromosomes, 6 pairs with median or nearly median primary constrictions and five chromosomes with sub-terminal primary constrictions.

In all, there are four SAT chromosomes, one pair of long SAT chromosome S and S is morphologically identical, however other two SAT chromosomes S' and S'' are morphologically dissimilar (Fig. 1). The S' type is similar to the SAT chromosomes reported by Therman for the species studied. There are 2-3 nucleoli present in the nucleus of the somatic cells.

Structural heterozygosity in the chromosome complements is indicated by the presence of some odd chromosomes—for which it was not possible to find out the morphological homologue. One pair of SAT chromosome S' and S'' are dissimilar (Fig. 1). Such structural hybridity in the karyotype has earlier been reported by Therman⁸ in different European strains of the allied genus *Polygonatum verticillatum*. Recently the present author (Kumar¹⁰) has also reported structural hybridity in the Himalayan forms of the same species.

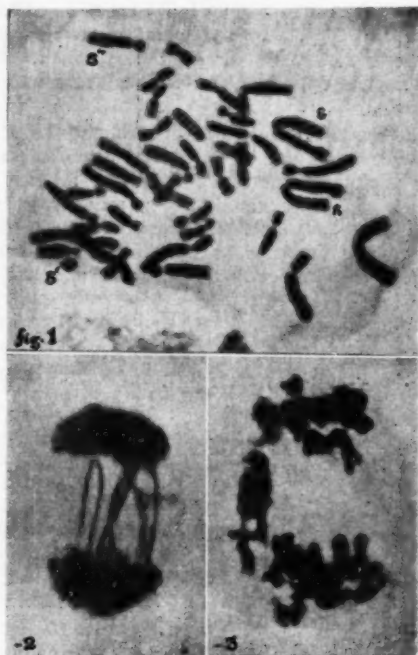


FIG. 1. Metaphase in Root Tip Cell showing 36 Chromosomes.

FIGS. 2 & 3. Anaphase I, showing Meiotic Abnormalities.

At Anaphase I of meiosis certain irregularities like dicentric bridges and acentric fragments and stickiness in the separating chromosomes were observed, thus revealing heterozygosity for inversions (Figs. 2, 3). Since the plant possesses an efficient mode of vegetative reproduction by rhizomes—such irregularities probably tend to accumulate in the genus. It is likely that the cumulative effect of these structural changes may be of help in bringing about new chromosome types, and thus increasing the phenotypic variability within the species.

Regarding the basic number for the genus, the haploid number $n = 18$, so far known for the various species, seems to be high to be the primary basic number. However, Darlington and Wylie¹¹ have kept $n = 9$ as the basic number for the genus. It is quite likely that the various species studied so far may be of polyploid origin. Autopolyploidy seems unlikely, since most of the chromosomes are repeated once only and the course of meiosis is also unlike those of autotetraploids.

The author is deeply indebted to Dr. M. S. Swaminathan, Cytogeneticist, I.A.R.I., for the encouragement and valuable suggestions which the author received during the course of this study. Thanks are also due to Mr. Jagdishan for his help in photomicrography. The author is also grateful to Mr. M. M. Begg, Principal, Delhi College, for his encouragement and to the Ministry of Scientific Research and Cultural Affairs, for a 'Grant-in-aid'.

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Delhi, June 16, 1959.

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PYGIDIAL GLANDS IN *PHEROPSOPHUS* SP. (CARABIDAE: COLEOPTERA)

THE nocturnal beetle *Pheropsophus* has been observed to eject a strong jet of volatile fluid with an audible sound through a pair of openings at the tip of its abdomen either to paralyse its prey or to escape from its enemy. The fluid is discharged by a pair of pygidial or anal glands (Bordas, 1899) which serve as organs of offence and defence.

Dierckx (1901) studied the pygidial glands in some Coleoptera. The glands in *Pheropsophus* are a pair of symmetrical structures lying below the abdominal terga VI-X, one on either side of the rectum and above the aedeagus in the male and vagina in the female. Each gland consists of a group of secretory lobes, their collecting tubes, the reservoir and the capsule opening to the exterior on the tenth tergum (Fig. 1).

There are a dozen secretory lobes which appear like bunches of white grapes, each with 5-7 small, radiating branches which meet in the centre and are free distally. A long, convoluted, slender collecting tube leads from the

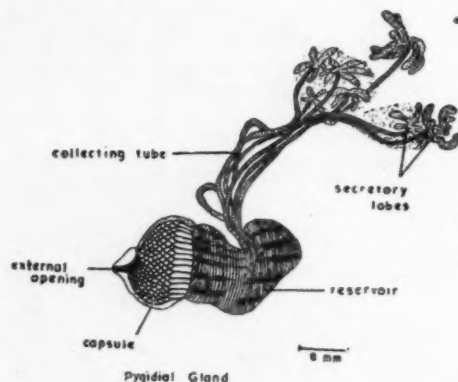


FIG. 1

centre of each lobe and all the collecting tubes join distally to form a common collecting canal which opens into the reservoir at the latter's mesial concavity. Each collecting tube is supported by annular thickenings along its length. The reservoir is a large, thick, bean-shaped structure of a dirty-white colour, richly supplied with tracheæ. There is a thick outer layer of circular muscles whereas the inner lining of its wall forms long plaits which either meet similar plaits from the other side or fuse with the wall opposite, with the result that the cavity of the reservoir is cut up into small spaces and the whole structure presents a

sponge-like appearance. The reservoir in fact is a storehouse for the fluid which is forced through the capsule to the exterior by the contraction of its walls. The reservoir opens distally into the capsule by a wide transverse opening. The capsule is a strongly sclerotized, rounded, hollow receptacle with a well chitinized rim round its proximal opening. The surface of the capsule is marked by alveoli, surrounded by ridges which are fringed with bristles. The alveoli are filled with a brown granular substance and the capsular muscles are inserted on the surface of the capsule. The cavity of the capsule leads posteriorly into a wide, weakly sclerotized excretory duct which opens to the exterior on the tenth tergum. The histological details of the various parts will be reported later.

The beetles in captivity, when roughly handled, produce the fluid. It is almost colourless and has a pungent odour. It stains the surface on which it is thrown, leaving a greenish-yellow residue on evaporation. The secretion is corrosive and produces an irritation lasting for a few hours. It is soluble in water and has no reaction with litmus but turns ferrous sulphate solution black, which shows that it contains oxides of nitrogen. According to Wigglesworth (1950) the secretion is said to contain nitrous acid and nitrites in some bound form.

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April 22, 1959.

1. Bordas, L., *Ann. Fac. Sci. Marseilles*, 1899, 9, 205.
2. Dierckx, F., *La Cellule*, 1901, 18, 255.
3. Wigglesworth, V. B., *The Principles of Insect Physiology*, London, 1950.

ACOUSTICAL MEANS OF STUDYING GRAVITATIONAL WAVES

THE field equations of general relativity predict that a rotating body will radiate a gravitational wave. Thus a rod of length 1 m. and mass 1 kg. rotating at 100 rps., according to Eddington (*Mathematical Theory of Relativity*) would radiate gravitational flux at the rate of 6.4×10^{-30} erg/sec. Prof. J. Weber, of the University of Maryland, has suggested possible acoustical means of detecting and generating such radiation. Gravitational waves striking a solid will set up strains in it, and these might be detected by suitable and sufficiently sensitive piezo-electric crystal attached to the solid. To achieve sufficient sensitivity to observe gravitational radiation from outer space it might be necessary to use as the vibrating mass a moun-

tain or even the earth itself, provided seismic disturbances could be effectively screened out.

A vibrating solid might serve as a terrestrial source of gravitational radiation. Prof. Weber shows that a quartz cube treated as a mass quadrupole radiator might under feasible conditions radiate as much as 10^{-15} erg/sec. of gravitational flux. This could be materially increased if the tensile strength could be increased. At present reception does not seem practicable for intensities less than 2×10^{-8} erg/cm.²/sec. Details of Weber's work are not available but acousticians will be interested in this fascinating field of modern physics.—*J. Acoust. Soc. Am.*, 1959, 31, 1040.

REVIEWS

Sound Pulses. By F. G. Friedlander, Cambridge University Press, 1958. Pp. ix + 202. Price 40 sh.

It has been said that the development of the theory of sound would not have taken the course that it did if it were not for presence of a sound receiving organ in man. The human ear and Fourier's analytical theory conspired to set the pattern for the analysis of sound waves in terms of harmonic waves. The general technique of obtaining harmonic solutions of the wave equation appropriate to the prescribed initial and boundary conditions proved to be so fruitful that even aperiodic disturbances were analyzed (or synthesized) in terms of harmonic components.

The treatment of acoustic pulses in this book is based on the theory of linear hyperbolic partial differential equations. In this theory it is easily established that pulse-fronts, considered as hyper-surfaces in space-time, are characteristics of the wave equation. Pulse-fronts are reflected, propagated and diffracted in accordance with Fermat's principle and we thus have a body of theory which may be called geometrical acoustics.

Starting with the equations of motion of an inviscid medium, this monograph develops the concepts of wave-fronts and characteristics in space-time. The chapters that follow give a more complete discussion of the applications of geometrical acoustics to problems of reflection and diffraction. Diffraction of a pulse by wedge, half-plane, circular cylinder and sphere by the use of Green's functions receive a thorough treatment.

In the words of the author this book is essentially an essay on the pulse solutions of the wave equation. The treatment is essentially mathematical and can be of interest not only to workers in acoustics, but also in the field of electromagnetic theory.

B. S. RAMAKRISHNA.

Beneficiation of Low Grade Manganese Ores of India. P. I. A. Narayanan and N. N. Subrahmanyam. (Council of Scientific & Industrial Research, New Delhi), 1959. Pp. 183. Price Rs. 10-00.

This monograph is based on the comprehensive studies made by the authors and their

collaborators at the National Metallurgical Laboratory, Jamshedpur, on the possibility of beneficiating different types of low grade manganese ores available in India. Indigenous production of exportable grades of standard ferromanganese, rather than the export of raw high grade ore, has been accepted as a problem of national importance. But so far adequate attention has not been given to beneficiation and upgrading of low grade ores with a view to their economic utilisation. This monograph becomes at once important, particularly when one realises that 1 to 2 tons of low grade ore are discarded at the mine-site for every ton of high grade ore mined.

The first chapter gives the occurrence of manganese ores in India and other countries. The second and third chapters cover the production, export, consumption, price, uses and specifications of manganese ores. Chapter Four deals with methods of beneficiation and Chapter Five discusses the beneficiation studies made on Indian low grade manganese ores from different parts of the country. The authors summarise their work on this subject and give their recommendations in the final chapter of the monograph.

The monograph with its numerous tables, graphs and illustrations will be of great use to industry and trade concerned with manganese ores either for export or as raw materials for the production of ferro-alloys. The monograph is neatly printed and attractively got up.

A. A. KRISHNAN.

A Handbook of Colorimetric Chemical Analytical Methods. (Published by the Tintometer Ltd., Salisbury, England), 1959. Pp. 360. Price 30 sh.

The fifth edition of this illustrated book has been wholly rewritten and brought up to date and the book itself is now redesigned in loose-leaf form so that the tests can be conveniently revised or modified and incorporated. The published price covers also the cost of revision leaflets for a period of two years.

The book is divided into seven parts dealing with the apparatus used, pH, inorganic chemical analysis, organic chemical analysis, chemical pathological methods, noxious vapours and colour grading for quality respectively. More

than 150 complete analytical tests are incorporated.

This is an excellent book for its purpose and it should be in every chemical library and in all laboratories where Lovibond colour scale is adopted for colour comparison.

N. J.

The Mammals of North America. Two volumes.

By F. Raymond Hall and Keith R. Kelson.
(The Ronald Press Company, New York),
Pp. 1083 + 79. Price \$ 35.00.

This is a truly outstanding achievement. Not within a hundred years has an account of the mammals of North America appeared and it is clear that this work fills an important need. It has been a colossal undertaking, involving a great amount of labour and expense and the collaboration of a number of specialists. Dr. Hall's dedication of a life-time for the guidance and preparation of the work, and the devoted efforts of Dr. Kelson have been responsible for producing a book of monumental importance, one which will remain on the reference shelves of all whose work even remotely touches on mammals.

Over 3,000 species and subspecies are described here. The distribution of every one is shown on a map and drawings of a very large number of typical mammals have been made, along with their skulls. Their arrangement in the book is illustrative of what is known of their evolutionary sequence, starting with the Marsupialia. Even within each order, family or genus, the species known to be the oldest is treated first, the other species being listed according to their age.

One of the interesting features of taxonomic work in recent years is the gradual decrease in the number of species described. For instance, the number of species of North American mammals recognized in 1923 was 1,399; in 1953 it was 1,065; in 1957 (in the book under review) there are little more than 1,000. This decrease is largely due to the recognition of the fact that many of the species described earlier could now be regarded only as subspecies. It shows the trend of modern taxonomy, the necessity to recognize resemblances, even as, over a hundred years ago, Darwin himself did. Far too many species are listed and described, even as it is; but with the recognition of the basic unity underlying living organisms, the trend is sure to continue, and in other animals as well in mammals, a stable discipline will result—the New Systematics.

B. R. S.

Cytology and Cytogenetics. By Carl P. Swanson.
(Macmillan & Co. Ltd., London), 1958.
Pp. 596. Price 45 sh.

The establishment and elaboration of the Chromosome Theory of Inheritance imperceptibly ushered in the current phase of analyses of the nature of the gene, its reproduction and mode of action. The corpuscular discrete gene of classical Genetics has given place to the *operational gene* defined "as the smallest segment of the gene string that can be shown to be associated with the occurrence of a specific genetic effect" (p. 425). Its rather blurred boundaries is reminiscent of Goldschmidt's contention that the *hypothetical gene* of classical Genetics has no existence, that mutations are merely rearrangements of the chromosome at microscopic and sub-microscopic levels and that the hereditary potentialities are determined by the spatial relationships within the chromosome.

In that context the answers to the questions: "What is the chromosome?", "What does it do?", and "Why does it do what it does?", considered in this volume, are of topical interest. "The reader will observe that few definitive answers can be given, but it is believed that these discussions will be useful to those working in the immediate fields of cytology, genetics and evolution and also those in the areas of cellular physiology, embryology, systematics, medical research and plant and animal breeding" (p. vi).

A good background in Cytology is essential to appreciate the book and the brevity of treatment of the many problems stimulates but does not satisfy the curiosity of the reader. The volume would afford much food for thought to active investigators in the field.

M. K. SUBRAMANIAM.

Implantation of Ova—Memoirs of the Society for Endocrinology. No. 6. Edited by P. Eckstein. (Cambridge University Press, Cambridge, England), 1959. Pp. 96. Price 10 sh. net.

The present memoir of the Society for Endocrinology is the proceedings of a Conference held in November, 1957 to survey the vital phase in mammalian development during which the fertilised ovum becomes embedded within the uterine mucosa. The papers presented at the Conference have been arranged sequentially on the basis of morphological, histochemical and physiological studies.

The memoir is fittingly prefaced by an admirable general survey of ovum implantation

in mammals. The authors (Eckstein, Shelesnyak and Amorose) have outlined the nidational patterns in mammals and their variants, against a perspective of the analytical approaches that could be made for probing into the mysteries of the implantation problem. Harrison and Neal's paper is an account of the peculiar delayed implantation in European badger. The physiological mechanisms responsible for this phenomenon are still imperfectly understood but the authors have been able to show that at least the corpus luteum does not play any important role in the mechanism. Boyd's demonstration of the presence of intra and extracellular glycogen in certain anatomical components of the human implantation site is perhaps the first of its kind ever done. Lutwak-Mann has reviewed her notable contributions to the biochemistry of implantation. For obvious reasons, the reviewer feels that this is one of the most important papers in the memoir. The superb photographs of 6-day guinea-pig blastocyst from *in vitro* cultures (taken by Blandau) presented by Amorose chronicle the progressive morphologic changes in the attachment cone. The findings are in complete agreement with the classical studies of Graf von Spee and the relatively recent investigations of Blandau. On the pharmacologic side Robson has studied the effect of a number of compounds (spindle poison, chromosomal poison and antimetabolites) on pregnancy in mice. Shelesnyak reiterates his earlier view regarding the involvement of histamine in the process of decidua formation and nidation. The most significant point which emerges from this memoir is the concept of relative autonomy of the ovum within the uterus and the synchronization of some of the metabolic events in the ovum and the uterus to maintain this autonomy.

The present number of the *Memoirs of the Society for Endocrinology* like its predecessors is a worthy publication and research workers would look forward to the appearance of other numbers in this series devoted particularly to problems of mammalian reproduction.

A. B. KAR.

Journal of Medicinal and Pharmaceutical Chemistry. Vol. I, No. 1. (Interscience Publishers, New York, London), 1959. Pp. 1-120. (Bi-monthly Subscription £ 5.15 per year.)

Early dissemination of the results of research activities of the various laboratories is sure to benefit the scientists engaged in allied types of research. This new journal may be expected to fulfil this objective efficiently and quickly.

The increased tempo of pharmaceutical and pharmacological research all over the world is reflected in the pages of this journal.

The strong Editorial Advisory Board consisting of reputed Chemists and Pharmacologists is indicative of the international character of the journal. The main articles presented and discussed in this volume are:—

Hypotensive hydrazinophthalazines, pyrrole derivatives as a new class of antispasmodics, Alpha and Beta prodine type of compounds, Chemistry and Pharmacology of some synthetic organophosphorus compounds, derivatives of 3-Pyrrolidinols, compounds related to Pethidine and natural products from *Piper methysticum* Forst.

M. SIRSI.

Acetophenetidin. By Paul K. Smith. (Interscience Publishers, New York, London), 1958. Pp. x + 180. Price \$ 5.75.

This volume is the fourth in the series of monographs published by the Institute for the Study of Analgesic and Sedative Drugs. The chief value of this series lies in making available in one volume the pertinent literature found scattered in various journals all over the world.

Acetophenetidin, introduced as an antipyretic in 1887, is one of the very few drugs that has stood the test of time. It still occupies a prominent place amongst the innumerable, antipyretics and analgesics of recent origin.

This monograph on phenacetidin also deals with the major metabolite of this drug—N-acetyl-p-amino phenol. The aspects reviewed cover physical, chemical, biochemical, biological and pharmacological properties of these two compounds and ends with a comprehensive bibliographical index.

M. SIRSI.

Advances in Clinical Chemistry. Vol 1. Edited by Harry Sebotka and C. P. Stewart. (Academic Press, New York and London; India: Asia Publishing House, Bombay-1), 1958. Pp. xi + 308. Price \$ 12.00.

The first volume of the new series, *Advances in Clinical Chemistry*, with its laudable object of presenting an unbiased and critical discussion of many border-line subjects, is a worthy companion for the already well recognised 'Advances' Series.

Progress of medical science is mainly dependent on elucidating the fundamental biochemical abnormalities which underlie disease processes. Emphasis on this aspect has resulted in a new

and highly desirable orientation to clinical chemistry in this volume.

The topics discussed are widely divergent in nature. Plasma iron; the assessment of the tubular function of the kidneys; protein-bound iodine; radioactive iodine-131 in the diagnosis of hyperthyroidism; adrenocortical steroids; 5-hydroxy indoles; composition of the body fluids in childhood; clinical significance of transaminase activities of serum and paper electrophoresis in clinical investigations are the subjects dealt with in this volume.

The importance of these selective subjects needs no emphasis since they are in the forefront of clinical research all over the world. They are presented in a manner highly stimulatory and thought-provoking. The volume is a useful companion for both clinical chemists and clinicians.

M. SIRSI.

Tabulated Information on Tropical and Sub-Tropical Grain Legumes. (Plant Production and Protection Division, Food and Agriculture Organization of the United Nations, Rome, Italy), 1959. Pp. xiv + 367. Price \$3.50.

Grain Legumes or pulses are those leguminous plants which produce seeds or grain used primarily for human consumption. They include such important crop plants as groundnuts, soyabeans, lentils, peas, pigeon peas and the many other types which could, if properly developed, make a great contribution to human nutrition, particularly in tropical and sub-tropical countries where diets are generally deficient in proteins, fats and oils.

This publication brings together for the first time a wealth of information collected by the FAO from authentic sources from the various countries of the globe enclosed between 25° Latitude North and South.

The tabulated information consists of about 360 information sheets, one for each individual species or variety, arranged in alphabetical sequence. The information in each sheet consists of Identification, Station submitting the information, Source of crop, Genetic origin, Uses, Seed availability, Major insect pests, Major diseases, Morphology and Habit, Culture, Resistance to (factors), Yield and Quantity.

A publication such as this helps specialists in those regions to know what others possess in the way of varieties of these important crops and to pool their knowledge and experience.

Agricultural Research in India—Institutes and Organisations. By Dr. M. S. Randhawa. (Indian Council of Agricultural Research, New Delhi), 1958. Pp. v + 448. Price Rs. 20-00.

The importance of scientific development of agriculture in India cannot be overemphasized when it is realized that nearly 80% of her population live in villages and are directly dependent on agriculture for a living. Traditional methods of cultivation, harvesting of crops and marketing of the products according to the native genius of the people of the locality, though excellent in their own way, have certain inevitable drawbacks which are brought to the forefront under the rapidly changing conditions of living, the growing economy of the country as a whole and, above all, the increasing population where the rate of increase is threatening to outstrip the resources of the environments.

At the turn of the present century there was a general awakening of interest in the scientific study of agriculture in all the advanced countries of the world and this had its impact in India as well. The first fruit of this impact was the scheme to establish by the then Government of India, agricultural research institutes, experimental farms and agricultural colleges in different parts of the country. It was in the year 1905 that a munificent donation of £ 30,000 by Mr. Henry Phipps, an American philanthropist, enabled the establishment of the first Government of India Agricultural Research Institute (IARI), popularly known as the Pusa Institute, after the name of the village in Bihar where it was started. After the disastrous Bihar earthquake of 1935, the Institute was transferred to Delhi. In recent years under the aegis of the Ministry of Food and Agriculture rapid expansions have taken place in the IARI not only in buildings and expert staff but also in laboratory facilities, scientific equipments and experimental farms. It stands today as the premier institution of the country and one of the important sources of expert technical knowledge, advice and instruction in agriculture and its cognate branches.

After the First World War, as a result of the constitutional changes of 1919, agriculture became a provincial government subject and there was no agency between the Centre and the provinces to bring about co-ordination of work. In 1928 the Indian Council of Agricultural Research was established as a statutory body, with the primary function of promoting, guiding and co-ordinating agricultural research

throughout India. With the advent of freedom the Council has developed into a premier organisation which guides, finances and co-ordinates research problems connected with agriculture and animal husbandry. Another important function of the ICAR is the dissemination of results of research.

The volume under review *Agricultural Research in India—Institutes and Organisations* by the Council's Vice-President, Dr. M. S. Randhawa, gives an exhaustive account of the nine Central Research Institutes and seventeen Central Commodity Committees (pertaining to Cotton, Jute, Coconut, Oilseeds, Sugar, Lac, Tobacco) their research activities and achievements. It also contains the details of all research schemes sponsored by the ICAR.

Excepting the specialists who deal with researches and research organisations not much is known to the general public, and even to administrators in other fields, about the activities of the institutes and laboratories functioning under the Central Ministry of Agriculture. The present volume supplies the need by providing an integrated account of these research institutions and their organisation and activities. The volume is attractively got up and contains 79 plates of photographs and maps giving a wealth of information at a glance. The reviewer has it at his desk as a ready reference volume and he feels sure that every library, editorial and research establishment, administration department, agricultural institute and college will own a copy of this informative publication.

A. S. G.

Books Received

- Discovery Reports*, Vol. XXIX. *Octocorals (Part I) Pennatularians*. By H. Broch. Pp. 245-80. Price 17 sh. 6 d.; *The Faetal Growth Rates of Whales with Special Reference to the Fin Whale, Balænoptera physalus Linn.* By R. M. Laws. Pp. 281-308. Price 12 sh. 6 d.; *Distribution and Life-History of Euphausia triacantha Holt and Tattersal A. de C. Baker*, Pp. 309-340. Price 15 sh. (Cambridge University Press, London N.W. 1).
- The Analysis of Mixtures of Volatile Substances*. By Emil F. Williams and others. (*Annals of the New York Academy of Sciences*, Vol. 72, Art. 13), 1959 Pp. 559-785. Price \$ 4.00.
- Chlorpropamide and Diapetes Mellitus*. By M. G. Goldner and others. (*Annals of the New York Academy of Sciences*, Vol. 74, Art. 3), 1959. Pp. 407-1028. Price \$ 5.00.

- Quantum Aspects of Catalysis—The Drying of Linseed Oil*. By Raymond R. Myers. (*Annals of the New York Academy of Sciences*, Vol. 79, Art. 1), 1959. Pp. 1-8. Price 50 cents.
- Antibiotics Annual 1958-59*. Edited by Henry Welch and Felix Marti Ibanez. (Interscience Publishers, New York-1). Pp. xxii + 1107. Price \$ 12.00.
- Virus Growth and Variation*. Edited by A. Isaacs and B. W. Lacey. (Cambridge University Press, London N.W. 1), 1959. Pp. viii + 272. Price 35 sh.
- Excursion Flora of the British Isles*. By A. R. Clapham, T. G. Tutin and E. F. Warburg. (Cambridge University Press, London N.W. 1), 1959. Pp. xxxiii + 579. Price 22 sh. 6 d.
- Trigonometric Series*, Vols. 1 and 2. II Edition. By A. Zygmund. (Cambridge University Press, London, N.W. 1), 1959. Pp. xii + 383; vii + 354. Price 84 sh. each.
- Astronomy*, VII Edition. By Robert H. Baker. (D. VanNostrand Co., 358, Kensington, High Street, London W. 14), 1959. Pp. viii + 547. 52 sh. 6 d.
- I.C.A.R. Misc. Bulletin No. 82—Bovine Stars of India*. (Indian Council of Agricultural Research, New Delhi). 1957. Pp. 29. Price Rs. 2.37.
- Plant Nematodes, Their Bionomics and Control*. By J. R. Christie. (Agricultural Experimental Station, University of Florida, Gainesville, Florida), 1959. Pp. xi + 256.
- Biochemical Society Symposia No. 16—The Structure and Function of Subcellular Components*. Edited by E. M. Crook. (Cambridge University Press, London N.W. 1), 1959. Pp. 100. Price 15 sh.
- Electricity, Magnetism and Atomic Physics*, Vol. II—*Atomic Physics*. By J. Yarwood. (University Tutorial Press Ltd., Euston Road, London N.W. 1; India: Oxford University Press, Mount Road, Madras-2), 1958 Pp. viii + 644. Price 40 sh.
- Mites, or The Acari*. By T. E. Hughes. (The Athlone Press, London W.C. 1). Pp. vii + 225. Price 42 sh.
- The Two Cultures and the Scientific Revolution*. —The Rede Lecture by C. P. Snow. (Cambridge University Press, London N.W. 1), 1959. Pp. 51. Price 3 sh. 6 d.
- Introduction to Robot Technique—Multivibrator Circuits*. By A. H. Bruinsma. (Philips Technical Library, Eindhoven; India Philips India Ltd., Calcutta-20), 1959. Pp. 65. Price Rs. 5.00.

SCIENCE NOTES AND NEWS

Award of Research Degree

Andhra University has awarded the D.Sc. Degree to Sri. E. Bhagiratha Rao and Sri. P. Venkata Rao for their theses entitled "Studies on Drifts and Travelling Disturbances in the Ionosphere" and "Analysis of Electrical Machinery" respectively.

Symposium on Pilot Plants

Under the auspices of the National Metallurgical Laboratory, Jamshedpur, a Symposium on "Pilot Plants in Metallurgical Research and Development" will be held early in February 1960. Technologists and Research Scientists in the field are expected to contribute papers for discussion and take part in the Symposium. For further particulars please write to Dr. T. Banerjee or Mr. R. M. Krishnan, NML, Jamshedpur.

Symposium on "Hydraulic Machines"

A Symposium on "Hydraulic Machines" will be held in the last week of October in the Civil and Hydraulic Engineering Section of the Indian Institute of Science, Bangalore, in connection with the Golden Jubilee Year Programme of the Institute. Those interested in participating in the Symposium may please contact the Convener of the Symposium on "Hydraulic Machines", Civil and Hydraulic Engineering Section, Indian Institute of Science, Bangalore-12, for further details.

Fast Neutron Reactor

The August issue of the *Atomic Energy* magazine reports that the USSR has fully brought into commission a 5,000 kw. fast neutron reactor, the "BR-5". The reactor permits the use of Uranium-238 and Thorium for electric power generation. This will make the building of industrial atomic power stations economically profitable.—*USSR News*, August 21, 1959.

Gas Sterilisation of Seeds to Combat Pests

A new method of combating agricultural pests by treating seeds with gaseous nitrogen dioxide and ethylene monoxide has been evolved by Russian scientists. Experiments have shown that the pre-sowing gas treatment of seeds destroys all organisms causing infectious plant diseases of microbic, virus and helminthic

origin. Even the most hardy sporal micro-organisms perish completely. Gas sterilisation of seeds has no effect on their vitality. Maize grown out of sterilised seeds in experimental fields stood four metres high, and cotton had 25 to 27 bolls in every plant. There was no case of disease among experimental plants throughout the season.—*Soviet News*.

The Compton Current

The absorption of energetic X-rays and γ -rays by an insulator is due mainly to the Compton effect. It is also known that the Compton electrons are scattered preferentially in the forward direction. If, therefore, a unidirectional beam of X-ray or γ -ray photons falls on a slab of an insulator, there should be an electron current following the Compton effect. With present high-intensity radiation sources this Compton current can reach appreciable values and can be measured by suitable means. Incidentally, a measurement of the current can give information on the absorbed radiation dose.

In a recent paper (*Zeit. fur Phys.*, 1959, 153, 479), B. Gross has discussed the theory of the Compton current and derived an approximate expression for its value based on some experimentally valid assumptions.

In the experiment to test the theory, a beam of γ -rays of 1.26 Mev. from a Co-60 source is made to fall on a sheet of plexiglas in contact with a lead cube which acts as the collector of the Compton electron flux and at the same time completely absorbs the γ -ray beam. Since plexiglas has a low atomic number it also minimizes backscattering. A potentiometer system using a vibrating reed electrometer as a detector is employed to measure the current. The result of the experiment is shown to confirm the theoretical conclusions.

International Panel on Heavy Water Reactors

At the Second United Nations Scientific Conference on the Peaceful Uses of Atomic Energy, held in Geneva in September 1958, there was a proposal for holding panel discussions for exchange of experience in some specialized fields related to the basic design of reactors. Considerable work on reactor design has been done independently in different countries. If the data obtained from this work were co-ordinated

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and made generally available, a great deal of duplication of effort could be avoided. It was suggested that the IAEA (International Atomic Energy Agency) should take the initiative in arranging international co-operation in this field.

After examining the various aspects of reactor physics, the Agency decided to convene a panel to review, assess and correlate data on the physics of heavy water "lattices". For various reasons there is a widespread interest in the use of natural uranium as reactor fuel, and this has focussed attention in the design of heavy water moderated reactors. The term "lattice" refers to the pattern in which the fuel elements and the moderator are arranged in a reactor. The panel which met in Vienna from 31st August to 4th September 1959 was attended by leading scientists from different countries which have made significant progress in reactor physics and design. The publication of the results of the panel discussion will be a major contribution in reactor physics which will benefit all interested in the subject.

The Earth, Rockets and Meteors

Artificial satellites and rockets have become an important means of investigation of meteoric bodies in space. Particularly valuable data were obtained when they entered rather dense swarms of meteors. Each year our planet regularly meets certain streams of meteors, and at present the Earth is passing through the big Perseids meteoric stream, named after the Perseus constellation from which the cosmic particles seem to come. The existence of this stream, the largest known today, was known 1,200 years ago. It is scores of millions of kilometres wide and the total weight of the meteoric bodies it contains is about 500 million tons.

The Earth passed through the densest part of the stream on August 11-12. At this time the number of "falling stars" in the sky reached 50 to 60 an hour.

Sputnik III carries special apparatus to register the number of meteoric particles that strike its surface and their energy. With these apparatuses the density of meteoric matter in space surrounding the Earth has been determined. Calculations showed the average number of collisions was 0.1 to 0.15 per square metre per second. But at times, when the Sputnik passed through meteoric swarms, the number rose to several dozen and even hundreds.

A particularly important study of meteoric bodies was made by the cosmic rocket launched last January 2 that became a satellite of the sun. When the radio signals were deciphered and the calculations made, it was found that meteoric particles with a mass of about one-millionth of a gram strike the surface of the rocket once in several hours of flight.—(Article by V. Lutsky, through the courtesy of the USSR Embassy in India.)

Orientating Action of Polarised Light on Certain Dye Molecules

The following simple but remarkable phenomenon has been reported by A. Teitel, in *Die Naturwissenschaften*, 1957, Vol. 13, p. 370. A film of gelatine spread on a microscope slide and stained with a suitable dye, such as Congo Red, represents a surface which—when moist—is sensitive to polarised light. If the film is irradiated with white polarised light during the drying process, the irradiated spot exhibits a more or less permanent birefringence. Thus an invisible birefringent image of the light source or of a diapositive may in this manner be impressed on the surface, the image becoming visible only if the slide is viewed between crossed polaroids. As a detector of partially polarised light such a surface has an advantageous feature: in contrast to a usual analyser such as a nicol (which responds also to half of the unpolarised part of the incident light) the dye surface responds only to the polarised part, and hence may be useful for detecting feeble traces of polarisation.

The axes of birefringence of the irradiated spot lie along and perpendicular to the electric vector of the light, the latter (according to the explanation of Teitel) causing a mechanical orientation of the dye molecule. The observed sign of the birefringence is explicable only if the molecules tend to align themselves with their lengths perpendicular to the electric vector of the light, so that it must further be supposed that the light acts on certain active side radicals which lie perpendicular to the length of the molecule.

New Theory of the Expanding Universe

Lyttleton and Bondi have recently developed a new theory to explain the expansion of the universe. Basically, the theory rests on the hypothesis that the magnitude of the charge of the proton exceeds that of the electron by about 2 parts in 10^{18} . Such a difference would mean that the smoothed-out background material of the universe would have a volume

charge sufficient to produce an electrical repulsion giving the observed expansion rate. The galaxies and clusters of galaxies occur in the theory as condensations in ionized regions, and take part in the expansion because they form and continue to grow from the dispersing background material, which is maintained at constant density by continual creation of matter.

The theory has other consequences. For example, potential differences of the order of 10^{19} volts occur between ionized units (galaxies and clusters), and the charge-excess is driven off from them as protons with energy of this order. In this way the theory may give a reasonable explanation of how these ultra-high energy cosmic rays are produced.

The charge-excess required by the theory could equally well result from a slight excess in the number of protons over electrons everywhere, with their charges exactly equal and opposite. In either form of the hypothesis, creation of matter implies creation of charge, and the Maxwell equations accordingly require a minute amendment involving cosmical terms.

If the proton and electron charge do differ slightly, very small particles of matter would necessarily have non-vanishing electric charge. No experiments made to date would have disclosed the requisite small charge difference, but it is just possible that tests could be devised that would do so, and establish how closely the two charges do in fact approximate to equality in magnitude.—*Research*, June 1959, 12, 240.

Emission of He I, λ 10830 in Solar Flare

The presence of the infra-red helium line λ 10830, in the Fraunhofer spectrum was first reported in 1934 by H. D. and H. W. Babcock. It appears to have its origin entirely in the chromosphere, and outside the solar limb it is seen in emission.

The emission of this line on the solar disc has been reported only once before in 1939, when it was seen over a solar eruption of intensity 3 that occurred near the centre of the disc on December 7, 1938.

It is well known that the D3 line of He I, λ 5876, appears in emission in solar flares. Since λ 10830 (2^3S-2^3P) and λ 5876 (2^3P-3^3D) belong to the same triplet series and share a

common level one would expect the former also to be seen in emission in flares. This has been observed and reported by E. Tandberg-Hanssen, W. Curtis and K. Watson in a recent issue of the *Astrophysical Journal* (1959, 129, 238).

On August 26, 1958, there was an outstanding solar flare rated at 3+, beginning 0005 U.T., maximum 0027, end 0124. The above authors report that observations of this flare were made at Climax Observatory and good spectra of the infra-red region were secured. The spectra show the λ 10830 line both in emission and absorption in a flaring region. The paper contains a first analysis of the emission profile with a calculation of the intensity ratio of the two components. The He I, λ 10830 is really a triplet with its bright two red components very close together at 10830.25 and 10830.34 (not resolved in the spectra) and the blue component at 10829.04 very weak.

The Vertebrate Ear

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ERRATUM

Dr. N. K. Iyengar, the author of the article entitled "Applications of Electrophoresis Technique in Forensic Science," published in *Curr. Sci.*, 1959, 28, 316-19, writes that the following reference has been inadvertently omitted in his article. The same will read thus: (13) Goldbaum, R. and Williams, M. A., *J. Forensic Sciences*, 1959, 4, 144-52.

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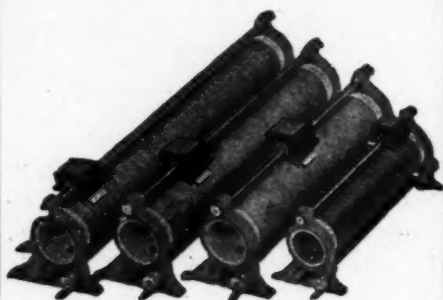
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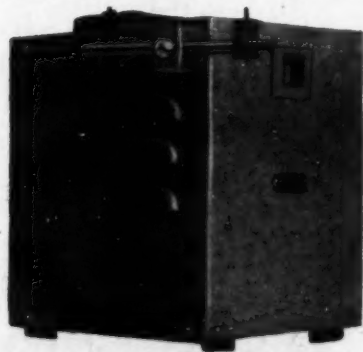
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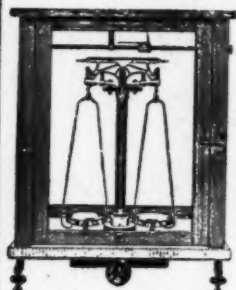
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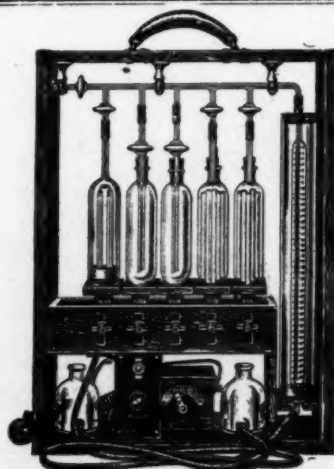


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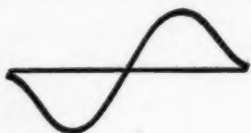
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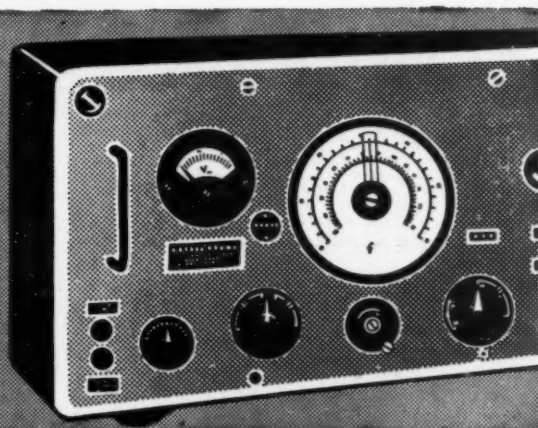
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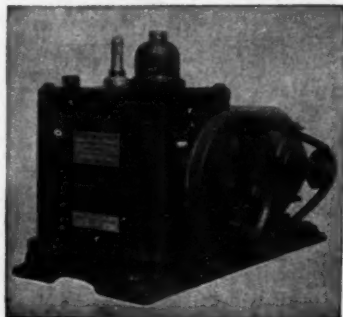
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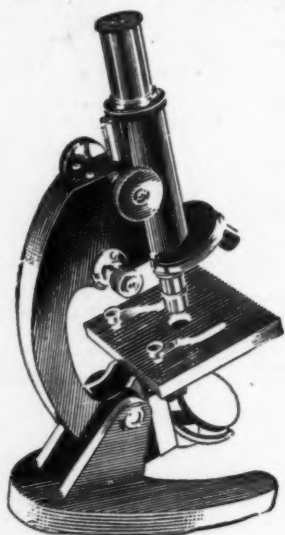
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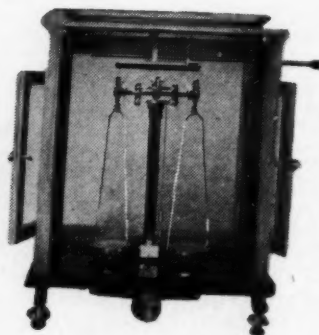
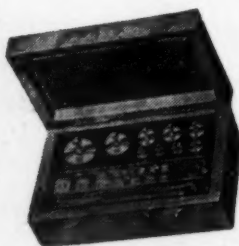
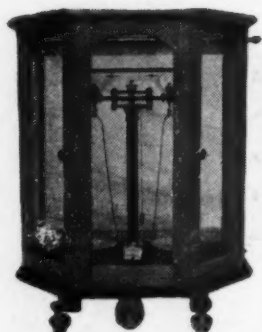
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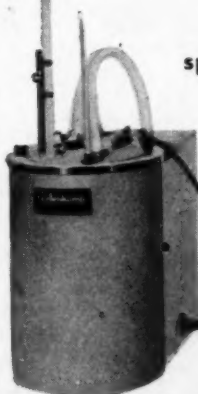
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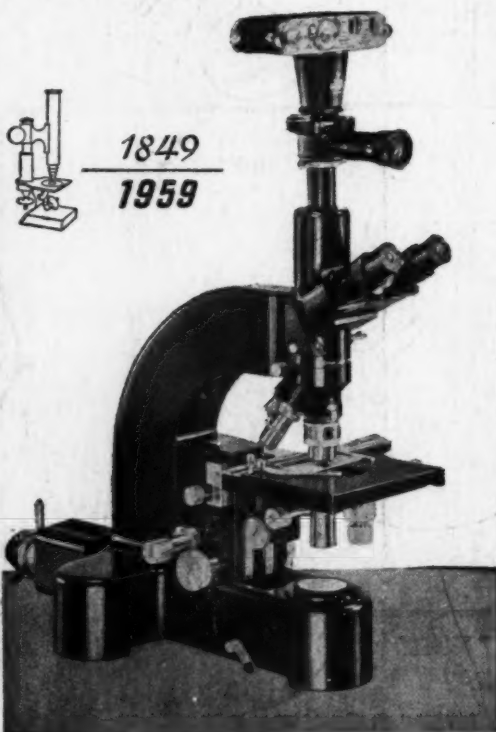
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